City of Baltimore
Department of General Services
Capital Projects Division

Addendum No. 2

Date: October 15 , 2025

For: General Information

For: CONTRACT NO. PRJ001888
FOREST PARK LIBRARY ADDITION AND RENOVATION

FOR THE MAYOR AND CITY COUNCIL OF BALTIMORE

TO THE BIDDERS:

THIS ADDENDUM IS HEREBY MADE A PART OF THE CONTRACT DOCUMENTS ON WHICH THE CONTRACT WILL BE BASED, AND IS ISSUED TO MODIFY, EXPLAIN AND/OR CORRECT THE ORIGINAL DRAWINGS AND SPECIFICATIONS.

PLEASE ACKNOWLEDGE THIS ADDENDUM ON THE BID OR PROPOSAL PAGE WHERE INDICATED.

APPROVED:

Jackson Gilman-Fortini *10/10/2025*

DESIGN PROJECT MANAGER

Shaquita Stewart **10/14/2025**

CONSTRUCTION PROJECT SUPERVISOR

MalinMendonca 10/10/2025

ARCHITECT SUPERVISOR

Marwan Alkarajat 10/14/2025

CHIEF, DESIGN AND CONSTRUCTION DIVISION

Burke Kittila 10/14/2025

DIRECTOR OF GENERAL SERVICES

WRITTEN QUESTIONS SUBMITTED

(NOTE: Questions are listed here in the order received)

Question #1: Is the Geotech report referenced in S0.1 - D.W. Kozera, dated 05.10.24 available?

Geotech report has been added to specifications as Exhibit One.

Question #2: Volume 2 of the bid books is out of order and/or missing spec sections. Will these be corrected and available as an electronic document? It appears Division 8 is included twice. Division 14 is included partially twice. The table of contents and the order of the books are not consistent. Also, the Table of Contents state there should be specifications sections for Division 31 – Earthwork and Division 32 – Exterior Improvements, these are not included. We just want to make sure we have all the correct information for bidding. Will you please advise if corrected specifications will be provided and/or how to proceed without the missing information.

Revised specifications are attached herein to Addendum #2 and correct these issues.

Question #3 Please provide a quantity or allowance for all the walls that need to be redone. General note 8 on almost all of the drawings says existing to remain walls to be patched, skim coated or otherwise repaired to as new condition. Verify extent of necessary repairs in the field.

Assume 30% of existing plaster finished walls will be required to be patched. It is estimated that there is 8,600 square feet of existing plaster walls.

Question #4 Who determines what walls need to be repaired per note 8 on drawing A1.10? The drawings point to the areas where the stairs are but there were damaged areas throughout that the drawings do not show.

See question #3.

Question #5 Will an engineer, or inspector office be required on site? There is no room onsite when the work for the exterior is going on, or inside when the demo phase is occurring.

A 200 sq. ft. temporary enclosed office within the library is required. Walls shall be GWB on framing with a clear plastic ceiling to allow light. Exact location to be mutually agreed upon between GC and Owner.

Question #6 How much is the building permit.

Include an allowance of $40,000 for the building permit.

Question #7 Will the bus stop be moved by the city?
The intent of the project is that the bus stop is to remain in place and operational. Contractor's traffic control plan to allow pedestrian and bus access to the shelter since it is outside the LOD. However, obtaining Right-of-way permits are the responsibility of the GC, and the GC shall abide by the requirements of the Department of Transportation at the time of the permit application.

Question #8 Please provide the Geotech report mentioned on drawing S0.1 but is not included.
See question #1

Question #9 Can this bid be extended? There is a holiday next week, and it will be a tight turnaround to get any answers or get with any sub contractors before the bid.
The city has issued the revised due date in Addendum #1.

Question #10 During the site visit there was a pool of water throughout the basement and all the trench boxes were completely filed with water. Has anyone tested the water to see if there is chloride in the water or is it spring water? Drawings do not mention anything about water in the basement.
Water in basement appears to be coming from existing sump pump and was not a condition seen on previous site visits. Assume this is a one-off condition and water management from existing sump pumps is a contractor means and methods.

Question #11 Is there a broken pipe in the building? There was a ton of water in the basement, and the issue looks like it has been going on for some time.
See Question #10

Question #12 Who is the fire alarm vendor?
Johnson Controls has the city contract for fire alarm services (installation and maintenance of equipment)

Question #13 Is there more than one vendor for the elevator? The spec book only has one company listed TK Elevator.
TK elevator is the basis of design. A manufacturer that meets the specifications is acceptable.

Question #14 Please provide a piping schedule for plumbing. Specs just list all materials but is not specific to what can be used in the execution section.
Refer to specification sections 221116 - Domestic Water Piping and 221316 - Soil, Waste and Vent Piping for additional piping information.

Question #15 Please confirm that door 009A is to be wood door with aluminum frame.

Door 009A is a solid core wood door in aluminum storefront framing (4/A5.05)

Question #16 Please provide the specification sections for the site scope indicated on the drawings.

Revised specifications will be issued electronically as part of Addendum 1

Question #17 Please clarify the activities and materials included in the scope for historical wood repair and restoration.

All existing wood doors, trim, details, fireplace surrounds, etc. to remain are considered part of the Historic Wood Repair scope of work.

Question #18 Please clarify the quantity of slate shingle that is noted as missing or damaged mentioned on AD1.10

Assume 800 SF (In central section of the building only. Wings to be fully replaced as per plans as per specs)

Question #19 Please clarify if the cost of masonry foundation wall repair should be included in the bid if unsatisfactory conditions discovered during excavation for install of waterproofing membrane and drainage protection board on existing masonry wall.

There are no known “unsatisfactory conditions” of the existing foundation walls. Repairs of unsatisfactory conditions is not included in the scope of work at this time.

Question #20 Please specify project start date (even if approximate)

The notice to proceed date will be approximately 30 days after the award of the contract by the Board of Estimates. It is intended that the contract will be awarded by the end of the calendar year. The project start date and project award is partially dependent on the bidder’s proper submission the bid without errors.

Question #21 Demolition note D22/AD1.10 states to re-point the existing water table cast stones. Is this typical for all the facades?

Yes

Question #22 Demolition note D23/AD1.10 states cleaning dirt and removing organic growth on masonry. The drawings do not match the extent of cleaning identified during the site visit on September 30th. Please confirm we are only to price what is established on the drawings

Additional growth of organic material has occurred since the library has been closed. Clean and remove all organic growth on the masonry.

Question #23 Demolition note D35/AD1.10 states to remove loose coping stones, clean mortar and prepare for re-installation. Should we assume a percentage of coping stone to be removed and mortar replaced, etc?

Assume 100% of all coping is loose.

Question #24 Per demolition note #D16/AD1.00, trim work including wall paneling, stair railing, handrail, stair stringer, etc. to be protected during construction; however, specification section 060312 - "historic wood repair" describes these components to be repaired. Please advise.

All trim work to be protected from damage during construction and repaired where necessary. Contractor's means and methods determine methodology for this.

Question #25 If existing wood paneling, railings and trim to be repaired, please provide extent and quantity for these repairs.

All existing wood paneling, railings and trim to remain to be repaired.

Question #26 Specification 014339 under paragraph 2.2 describes several integrated exterior mock-ups.

a. masonry cleaning

b. masonry repair

c. masonry repointing

d. new masonry installation

e. infill opening using existing masonry

Please indicate the sizes of each mock-up listed above

Size of mock-ups shown in specifications. If no size is indicated provide 4 square foot (2'-0" x 2'-0") mock-up.

Question #27 Drawing note # 10/HM 1.00 describes asbestos-containing facade mastic; however this information is not shown on elevations. Please provide location.

Suspected Hazardous and Regulated Materials Observed and Asbestos Sampling Report has been added to specifications as Exhibit two.

Question #28 Please provide Asbestos Report.

See Question #27

Question #29 Specifications 040310 - "historic masonry cleaning" describes preliminary cleaning. Is the intent to clean the entire building prior to any exterior work or this section only refers to mock-up cleaning and no preliminary cleaning required, please advise.

See demolition drawings for locations of masonry cleaning.

Question #30 Specifications 040310 - "historic masonry cleaning" describes removing plant growth. Is the intent to clean the entire building or this section only refers to mock-up cleaning? In addition, while at the site visit, the extent of plant growth removal is further beyond what the drawings depict. Please advise.

See Question #29

Question #31 Specifications 080314 - "historic treatment of wood doors" describes repairs to wood doors and trim. Are doors X001, X100, X101B, X102, X103, X105, XST01 and XST03 the existing doors associated with this specification section? If so, please provide the extent of repairs.

Yes. See Door schedule for extent of repairs.

Question #32 Please confirm that all windows listed in the window schedule are required to be aluminum-clad windows.

Confirmed.

Question #33 Please provide the quantity for window types Z and H, as these do not appear on the building elevations.

Type H is the transom window above window G. Sheet A3.00 has been modified to show this. Window Z is existing transom window above door X105.

Question #34 On elevation 5/A3.00, a window type N is shown; however, this type is not listed in the window schedule. Please clarify whether this should be an aluminum-clad window or a storefront window.

Type N is an aluminum clad wood window to match existing. The window is approximately 2'-4" x 5'-4".

Question #35 Please specify which product type should be used for the storm window above door 009B at 5/A3.00.

There is no specific manufacturer for the storm window. Install a fixed, ¼" glazed, aluminum frame, exterior storm window. Frame color to be white.

Question #36 Please confirm whether the door frame for Room 108 should be aluminum, as the door schedule currently specifies it as HM

Door to room 108 should be AL. Sheet A5.00 has been modified.

Question #37 Please provide information on the type of glass required for the storefront systems in Rooms 106, 107, and 108.

All glazing to be GL-1

Question #38 Can the windows be specified as Andersen Windows? The Andersen Window has vinyl cladding.

Aluminum Cladding is required.

Question #39 A5.00 Calls out door 009A to be wood with Alum frame. Please confirm

See question #15

Question #40 A5.00 The door schedule calls out that door 108 to be Alum, But frame is to be HM Please confirm Door 108 to be Alum, and the Frame to be Hollow Metal.

See question #36

Question #41 In the door schedule, please clarify that the 1" is for the exterior system and the monolithic to be the interior storefront.

In reference to the glazing, all doors are 1" IG. Storefront glazing is GL-2, 1" IG on exterior locations and GL-1 on interior locations.

Question #42 Storefront Specification does not have any information for Finish. Please clarify the finish.

See 084313; 2.6 for finish material. Color samples to be submitted to match existing limestone color.

Question #43 Please clarify the need for an infrared test before the new roof. Electrical capacitance/ impedance testing is only possible with a leak detection system inside the roof, which is not specified. Is a leak detection system required? If so, please specify whether a conductive mesh or conductive primer is required. (primer is much more expensive).

Infrared test is required after roof membrane installation. No conductive testing is required.

Question #44 On detail 3/A7.00, is the fiberglass Z furring shown on this detail the product in 070543.11? Can this be eliminated? Insulation comes in 4 foot spans and the height of this detail is only 2.5 foot.

Z furring is 24" OC and is required for support of sheathing. GC can propose alternate details for consideration which meet the thermal properties provided by the existing design.

Question #45 There are massive variances in slate shingle pricing depending on the size and quarry. The same slate from the same quarry could have a 50% price increase depending on what size it is. "Match existing" is not an acceptable specification without the city providing us what the existing is. At the very minimum we need a specific size shingle to price correctly.

New slate to match existing slate on center portion of the building. The existing slate is approximately 10" wide. Match existing means matching the physical appearance in terms of color, texture, size etc. based on a visual observation of the existing slate.

Question #46 There's a lot of missing frame dimensions on Sheet A5.05. Can a revised sheet be released with the frame dimensions?

Additional dimensions have been added to sheet A5.05.

Question #47 Study Room elevations on Sheet A8.05. Missing dimensions and glass type callouts. I'm assuming GL-1, but can you confirm? And, can you confirm the dimensions for the Folding Glass Partition by Nanawall (between Study Rooms 106 & 107).

Glass type for Study rooms is GL-1. Dimensions for aluminum framing is shown in Addendum #2 Sheet A8.05.

Question #48 The 084313 Aluminum-Frame Storefronts specifications don't call out a manufacturer, is there a basis-of-design? Or can you confirm Kawneer is an acceptable manufacture. Also, under 2.6 Aluminum Finishes, we are to match the Architect's sample in a 3-coat paint, please clarify what that is.

Kawneer is an acceptable manufacturer, or approved equal. Color of 3 coat paint will match Limestone on existing building. Samples to be submitted for final selection.

Question #49 On the Door Schedule on A5.00, Door 108 is marked as an "HM" frame, please confirm that is an error and should be AL to match doors 106 & 107. And please confirm 009A is a wood door by others in an aluminum frame; details 4/A5.05 & 11/A8.02 depict this as an all-glass door, confirm what type/style of door is desired here.

See question #36.

Question #50 Finish Schedule A8.00 calls for SEALED CONCRETE (SC) SC-1 to be REFER TO PROJECT MANUAL. Spec Section 099124/3.6.A calls for Solvent-Based Concrete Floor Sealer System, MPI # 104. Sherwin-Williams H&C ClariShield Solvent-Based Gloss Concrete Sealer meets MPI #104, however is not available in MD due to state VOC regulations. Please advise if Sherwin-Williams H&C ClariShield Water-Based Wet-Look Sealer MPI #99 is acceptable. Also please advise if slip/skid-resistant additive (H&C SharkGrip Slip Resistant Additive or similar) should be added to topcoat.

See specification Section 033500 for concrete floor sealer. Specification Section 099124 has been revised

Question #51: Please advise all Interior Wood Trim, Crown, Chair, Corbels, Fire Place Surround etc. are to be painted PT-2 SW 7043 Worldly Gray only. Current condition show many of it with 2-color scheme (Img. 8, 9/AD2.01 & 9, 10/AD2.02).

Interior wood trim is to be painted single color scheme PT-2. Exception is new woodwork identified as WD-1 finish.

Question #52 Please advise all Exterior Wood Trim/Frieze/Rake/Fascia Boards/Soffits/Corbels, Fiberglass Trim etc. to be primed/painted.

All exterior wood/fiberglass etc. to be primed/painted as specified.

Question #53 Armstrong acoustical ceiling tiles are specified. Will you entertain other manufacturer equals in an attempt at value engineering?

Matching ceiling tile by another approved equal manufacturer will be entertained if product is equivalent in properties and performance.

Question #54 As seen in the site pics there are a lot of existing walls that need various degrees of patching and repair on multiple substrate types. This is very difficult to quantify and price, especially as it appears to be plaster surface for the most part, which is difficult to ensure good adhesion of new finish. Would you consider putting in an allowance for patching and doing the repairs on a T&M basis?

See question #3.

Question #55 Meeting Room 009, Interior Partition Wall Treatment: Detail 11/A8.02 indicates that WT-3 is to be provided at the interior partition. However, Plan A2.2 identifies this area with WT-1. Could you please confirm whether WT-1 or WT-3 should be used at the interior partition in the Meeting Room 009?

WT-1 is correct.

Question #56 Bay Windows in Rooms 104 (Children) and 109 (Adult): Plan A2.01 labels these windows with WT-1. Detail 4/A8.15 shows one motorized shade covering both the upper and lower windows. Meanwhile, Interior Elevations 4/A8.04 and 14/A8.05 show WT-2 (manual shades) with two separate shades per window (upper and lower part). Could you please confirm whether WT-1 (motorized single shade) or WT-2 (manual single shade) should be provided at these bay windows?

WT-1 shall be installed in bay windows.

ATTACHMENTS

SPECIFICATIONS BOOK 1 (REVISED)

SPECIFICATIONS BOOK 2 (REVISED)

A3-00 EXTERIOR ELEVATION-EXISTING BUILDING (REVISED)

A5-00 – DOOR & WINDOW SCHEDULE (REVISED)

A5-05 – GLAZING ELEVATIONS – DETAILS (REVISED)

A8-05 INTERIOR ELEVATIONS (REVISED)

END OF ADDENDUM NO. 2

Specifications for:

City of Baltimore
Department of General Services
Design and Construction Division

Contract No. PROJ 1801

Forest Park Library

Addition and Renovation

3023 Garrison Blvd.
Baltimore, Maryland 21216

PRIME AE
Trust Is Built.

100% CD Submission
February 7, 2025

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BOOK 1

Division 00 through Division 14

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BOOK 1

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EXHIBIT TWO - SUSPECTED HAZARDOUS AND REGULATED MATERIALS OBSERVED AND ASBESTOS SAMPLING REPORT[6]

END OF DOCUMENT 000102

[6] Addendum 2

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DOCUMENT 000101 - PROJECT TITLE PAGE

1.1 PROJECT MANUAL VOLUME 1 - 100% CD Submission

A. Forest Park Branch Library Renovation.

B. Owner: Enoch Pratt Free Library, City of Baltimore.

C. Baltimore, Maryland.

D. Owner Project No. PROJ 1801.

E. Architect Project No. 2MD01AD-22057.

F. Prime AE Group, Inc.

G. 5521 research Park Drive, Suite 300, Baltimore, Maryland, 21228.

H. Phone: 833-723-4768.

I. Website: Primeeng.com.

J. Issued: February 7, 2025

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END OF DOCUMENT 000101

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DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

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1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. An existing asbestos report for Project, prepared by Aria Environmental, Inc., dated June 2024, is available for viewing as appended to this Document.

C. An existing lead report for Project, prepared by Aria Environmental, Inc., dated June 2024, is available for viewing as appended to this Document.

D. An existing PCB (Polychlorinate Biphenyl) information report for Project, prepared by Aria Environmental, Inc., dated June 2024, is available for viewing as appended to this Document.

E. Related Requirements:
   1. Section 024119 "Selective Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

END OF DOCUMENT 003126

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Suspected Hazardous and Regulated Materials Observed and Asbestos Sampling Report
for
Enoch Pratt Free Library
Forest Park Branch
3023 Garrison Boulevard
Baltimore, MD

PREPARED FOR:

PRIME AE Group, Inc.
5521 Research Park Drive, Suite 300
Baltimore, MD 21228

Prepared by:

Aria Environmental, Inc.
PO Box 286
Woodbine, MD 21797

JUNE 2024

241467

Suspected Hazardous and Regulated Materials Observed and Asbestos Sampling Report
for
Enoch Pratt Free Library
Forest Park Branch
3023 Garrison Boulevard
Baltimore, MD

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Attachment B: Asbestos Certificates of Analysis and Chain-of-Custody Forms
Attachment C: Sample Location Plan

HAZARDOUS MATERIALS SURVEY REPORT FOR ENOCH PRATT FREE LIBARARY, FOREST PARK BRANCH, BALTIMORE, MARYLAND

I. EXECUTIVE SUMMARY

Aria Environmental, Inc. (AE) was contracted by PRIME AE Group in 2020 to perform a visual hazardous materials survey of the Forest Park Branch located at 3023 Garrison Boulevard in Baltimore, Maryland. The purpose of the purpose of the initial visual survey was to identify and characterize suspect hazardous or regulated building materials that may require further investigation prior to demolition or renovation.

The Forest Park Branch of the ENOCH Pratt Free Library was built in 1910. In April of 1964, two new wings were added to the library, nearly doubling its size. The library was rededicated in February of 1987 after another major renovation project. The library served the local neighborhoods of Baltimore. It is currently closed for renovations.

Observed building finish materials in the library included: plaster walls, drywall, joint compound, various colors of 12"x12" and 9"x9" floor tiles, and mastic, carpeting, decorative plaster cornices, aluminum windows, wood doors and drop ceiling tiles.

AE performed a visual inspection in January of 2020 to identify suspected hazardous and regulated materials that may be present in the building that would require further testing and inspection, special handling and disposal in the event of building renovation or demolition. Aria returned in May 2024 to perform an asbestos survey of suspect materials and to collect samples for analysis to identify asbestos containing materials the will require abatement prior to any renovations to the building.

The survey for hazardous materials at the Forest Park Library indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to demolition. Our recommendations are summarized below:

1. Remove and dispose of all asbestos-containing 9"x9" floor tiles identified at various locations throughout the lower level (staff area) of the library.
2. Remove and dispose of asbestos-containing black sink insulation identified in the kitchen/break room of the library.
3. Remove and dispose of all asbestos-containing black mastic identified in association of 12"x12" floor tile located throughout the lower level of the library.
4. Remove and dispose of asbestos-containing exterior window caulk from all windows.
5. Remove and dispose of asbestos-containing exterior vent caulk.
6. Remove and dispose of asbestos-containing exterior expansion joint mastic.
7. Remove and dispose of asbestos-containing exterior façade mastic.
8. Sample and analyze or remove mirror mastic as assumed asbestos containing materials.
9. Sample and analyze or remove roofing as assumed asbestos containing materials.
10. Sample and analyze or remove fire doors as assumed asbestos containing materials.
11. Remove and dispose of battery-containing lighted exit signs and emergency lights as universal waste.
12. Remove and dispose of oil-containing automatic door closers.
13. Inspect fluorescent lamp ballasts for a "no PCBs" label. Dispose of any that DO NOT have this label as PCB-containing waste.
14. Remove and dispose of fluorescent lamps, compact fluorescent bulbs and incandescent bulbs as universal waste.

15. Materials may be concealed behind solid walls, ceilings or in pipe chases. Demolition activities have the potential to expose additional asbestos-containing materials. Caution should be taken while demolishing solid ceilings and walls.
16. Lead-based paint was not surveyed but is expected to be present, due to the age of the facility. It is highly recommended that a full lead-based paint survey is performed. Any disturbance to painted surfaces that contain any detectable levels of lead should be performed in accordance with OSHA "Lead in Construction Rule (29 CFR 1926.62)" and the Lead Renovation, Repair and Painting Rule. Waste should be analyzed by toxicity characteristic leaching procedure (TCLP).

HAZARDOUS MATERIALS SURVEY REPORT FOR FOREST PARK BRANCH LIBRARY

II. INTRODUCTION

Aria Environmental, Inc. (AE) was contracted by PRIME AE Group in 2020 to perform a visual hazardous materials survey of the Forest Park Branch located at 3023 Garrison Boulevard in Baltimore, Maryland. The purpose of the purpose of the initial visual survey was to identify and characterize suspect hazardous or regulated building materials that may require further investigation prior to demolition or renovation.

The Forest Park Branch of the ENOCH Pratt Free Library was built in 1910. In April of 1964, two new wings were added to the library, nearly doubling its size. The library was rededicated in February of 1987 after another major renovation project. The library served the local neighborhoods of Baltimore. It is currently closed for renovations.

Observed building finish materials in the library included: plaster walls, drywall, joint compound, various colors of 12"x12" and 9"x9" floor tiles, and mastic, carpeting, decorative plaster cornices, aluminum windows, wood doors and drop ceiling tiles.

AE performed a visual inspection in January of 2020 to identify suspected hazardous and regulated materials that may be present in the building that would require further testing and inspection, special handling and disposal in the event of building renovation or demolition. Aria returned in May 2024 to perform an asbestos survey of suspect materials and to collect samples for analysis to identify asbestos containing materials the will require abatement prior to any renovations to the building.

Based upon the age of the original construction, as well as the additions, hazardous and regulated materials are expected to exist on the property. This report presents our methodologies; results of sampling and analysis activities; and our conclusions and recommendations for abatement. Copies of the inspectors' credentials are included as Attachment A.

III. METHODOLOGY

A. Asbestos

On May 30, 2024, representatives of AE conducted an asbestos survey of the interior and exterior of the Forest Park Branch Library, located at 3023 Garrison Boulevard in Baltimore, Maryland. A visual inspection for suspected asbestos-containing materials was performed followed by asbestos sample collection and laboratory analysis. Work was performed by Julia Fafard (Maryland Asbestos Inspector Management Planner No. MD-230004825, exp. 10/10/2024).

Bulk samples of each suspect asbestos-containing material encountered by the inspector were collected in randomly located areas. A clean sampling tool was used to obtain a "thumbnail" sized bulk sample. This sample was placed in a single-use 4-mil plastic bag, sealed and labeled. The sampling tool was cleaned with an amended water solution before and between uses. Samples were submitted to SEEML Labs of Greenville, SC (NIST-NVLAP Accreditation No. 201031-0) for analysis by Polarized Light Microscopy (PLM) using EPA method 600/R-93/116. A material is considered to be asbestos containing, if it contains one percent (1%) or more asbestos by PLM.

Suspect asbestos-containing materials were not sampled if they were located behind solid walls and ceilings, or in enclosed pipe chases that would have to be damaged to access the suspect building materials. Suspect asbestos-containing materials were also not sampled if there had been previous sampling to confirm a positive or negative result. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground, but is not likely.

B. Lead

A lead-based paint survey was not performed, however, based upon the age of the structure and the presence of interior and exterior painted wood, plaster and drywall surfaces, lead-paint is likely present. Furthermore, the building is considered a child occupied facility and will require compliance with the OSHA Lead in Construction Standard, Maryland Reduction of Lead Risk in Housing, and Lead Renovation Repair and Painting Rules.

MDE defines "*Lead-containing substance*" as "*any paint, plaster or other surface coating material containing more than 0.50 percent lead by weight calculated as lead metal in the dried solid, or more than 0.7 milligrams per square centimeter by the X-ray fluorescence analyzer*." [COMAR 26.02.07.02]. EPA states "*Lead-based paint is present:(i) On any surface that is tested and found to contain lead equal to or in excess of 1.0 milligrams per square centimeter or equal to or in excess of 0.5% by weight; and (ii) On any surface like a surface tested in the same room equivalent that has a similar painting history and that is found to be lead-based paint*." [Title 40 CFR 745.227(h)].

C. Polychlorinated Biphenyls

Polychlorinated biphenyls (PCB's) are a class of chemicals that were used in a wide variety of applications. PCBs are often found in dielectric fluids, cooling fluids, transformers, capacitors and caulks. PCB-containing equipment must often be disposed of as part of renovation and demolition projects. The EPA definition of PCB-containing materials is 50 parts per million (ppm) or milligrams per kilogram (mg/kg). A representative number of fluorescent light ballasts should inspected for the presence or absence of the "No PCBs" label. If the "No PCBs" label is absent, then the ballast is considered to contain PCBs. The number of ballasts was estimated based upon the type of light fixture observed in the building. Light ballasts were counted as follows: one ballast for every two four-foot fluorescent light tube observed in a multi-tube fixture and one ballast for every one four-foot or eight-foot fluorescent light tube observed in a single fluorescent light tube fixture that is not joined to a second light fixture with a shared ballast.

D. Mercury

Mercury within fluorescent lamps, thermostats, thermometers, and other mechanical equipment often must be disposed of during renovation and demolition activities. Each area Should surveyed for accurate counts of thermostats and/or equipment that may contain liquid mercury. Fluorescent light tubes may contain small amounts of mercury vapor and lead. Because disposal of fluorescent light tubes is regulated under the EPA Universal Waste rule, a count of fluorescent lamps should be identified.

E. Refrigerants

Refrigerant-containing equipment including refrigerators, freezers, and air conditioning units were identified for the purpose of recycling chlorofluorocarbon (CFC) and

hydrochlorofluorocarbon (HCFC) refrigerants that are known to deplete ozone. Under EPA's Refrigerant Recycling Rule, equipment that is typically dismantled on-site before disposal (e.g., retail food refrigeration, central residential air conditioning, chillers, and industrial process refrigeration) require refrigerant recovery.

IV. RESULTS

A. Asbestos

A visual inspection for suspected asbestos-containing materials was performed by AE. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground.

Representatives of AE conducted an asbestos survey of the interior and exterior of the Forest Park Branch Library in Baltimore, Maryland. Bulk samples of suspect asbestos-containing materials were collected by AE during the asbestos survey activities. Seventy-six (76) samples were collected and submitted for analysis by PLM. The lab split forty-three samples with distinct layers for a total of one hundred and forty-two (142) analyses. Twenty-one (21) of the one hundred and forty-two (142)samples analyzed were greater than 1% asbestos. Table 1 presents the samples and results. The chain of custody and certificates of analysis are located in Attachment B. A plan showing sample locations is included in Attachment C.

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-01	Yellow Carpet Glue	Main Room	NAD
FPB-02	Yellow Carpet Glue	Main Room	NAD
FPB-03A	Plaster-White Skim Coat	Main Room	NAD
FPB-03B	Plaster-Gray Base Coat	Main Room	NAD
FPB-04A	Plaster-White Skim Coat	Entrance to Children's Section	NAD
FPB-04B	Plaster-Gray Base Coat	Entrance to Children's Section	NAD
FPB-05A	Joint Compound	Entrance to Children's Section	NAD
FPB-05B	Drywall	Entrance to Children's Section	NAD
FPB-06A	Plaster-White Skim Coat	At Adult Section	NAD
FPB-06B	Plaster-Gray Base Coat	At Adult Section	NAD
FPB-07A	White Textured Coat	Server Room	NAD
FPB-07B	Joint Compound	Server Room	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-07C	Drywall	Server Room	NAD
FPB-08	Acoustical Wall Tile 1'x1'	Children's Section	NAD
FPB-09	Acoustical Wall Tile 1'x1'	Children's Section	NAD
FPB-10A	White Acoustical Tile	Children's Section	NAD
FPB-10B	Brown Mastic Patty	Children's Section	NAD
FPB-11A	Yellow Mastic	Entrance to Children's Section	NAD
FPB-11B	Leveling Compound	Entrance to Children's Section	NAD
FPB-11C	12"x12" Orange Floor Tile	Entrance to Children's Section	NAD
FPB-11D	Black Mastic	Entrance to Children's Section	NAD
FPB-12A	Yellow Mastic	Entrance to Children's Section	NAD
FPB-12B	12"x12" Orange Floor Tile	Entrance to Children's Section	NAD
FPB-12C	Black Mastic	Entrance to Children's Section	NAD
FPB-13	Brown Mastic Patty	Server Room	NAD
FPB-14A	Gray Leveling compound	Entrance to Adult Section	NAD
FPB-14B	Yellow Mastic	Entrance to Adult Section	NAD
FPB-15A	Yellow Mastic	Entrance to Adult Section	NAD
FPB-15B	12"x12" Orange Floor Tile	Entrance to Adult Section	NAD
FPB-15C	Black Mastic	Entrance to Adult Section	NAD
FPB-16A	Yellow Mastic	Adult Section	NAD
FPB-16B	12"x12" Orange Floor Tile	Adult Section	NAD
FPB-16C	Black Mastic	Adult Section	NAD
FPB-17A	Plaster-White Skim Coat	Employee Rest Room	NAD
FPB-17B	Plaster-Tan Base Coat	Employee Rest Room	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch
3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-18A	Plaster-White Textured Coat	Stairwell	NAD
FPB-18B	Plaster-White Skim Coat	Stairwell	NAD
FPB-18C	Plaster-Brown Base Coat	Stairwell	NAD
FPB-19	Grout with 12"x12" Ceramic Tile	Employee Rest Room	NAD
FPB-20A	12"x12" White Floor Tile	Public Rest Room	NAD
FPB-20B	Yellow mastic	Public Rest Room	NAD
FPB-21A	12"x12" White Floor Tile	Public Rest Room	NAD
FPB-21B	Yellow mastic	Public Rest Room	NAD
FPB-22A	12"x12" Brown Floor Tile	Side Entry Vestibule	NAD
FPB-22B	Yellow mastic	Side Entry Vestibule	NAD
FPB-22C	Gray Leveling Compound	Side Entry Vestibule	NAD
FPB-22D	Off-White Mastic	Side Entry Vestibule	NAD
FPB-23A	12"x12" Brown Floor Tile	Side Entry Vestibule	NAD
FPB-23B	Yellow mastic	Side Entry Vestibule	NAD
FPB-23C	Gray Leveling Compound	Side Entry Vestibule	NAD
FPB-23D	Off-White Mastic	Side Entry Vestibule	NAD
FPB-24	Grout with 4"x4" Terra Cotta Tile	Main Entry Vestibule	NAD
FPB-25	Toilet Caulk	Public Rest Room	NAD
FPB-26	Toilet Caulk	Employee Rest Room	NAD
FPB-27A	Drywall Joint Compound	Public Rest Room	NAD
FPB-27B	Drywall	Public Rest Room	NAD
FPB-28A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-28B	Brown Brick	Hall/Stairs Lower Level	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-29A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-29B	Brown Brick	Hall/Stairs Lower Level	NAD
FPB-30A	Plaster-White Textured Coat	Staff Work Area	NAD
FPB-30B	Plaster-White Skim Coat	Staff Work Area	NAD
FPB-30C	Plaster-Tan Base Coat	Staff Work Area	NAD
FPB-31	Flange Sealant	Boiler Room	NAD
FPB-32	Flange Sealant	Boiler Room	NAD
FPB-33	Yellow Tape	Boiler Room	NAD
FPB-34A	Yellow Tape	Boiler Room	NAD
FPB-34B	White Mastic on Duct	Boiler Room	NAD
FPB-35A	Black Mastic	Staff Room	NAD
FPB-35B	**Black Floor Tile**	**Staff Room**	**4% Chrysotile**
FPB-35C	Yellow Mastic	Staff Room	NAD
FPB-36A	Black Mastic	Staff Room	NAD
FPB-36B	**Black Floor Tile**	**Staff Room**	**4% Chrysotile**
FPB-36C	Yellow Mastic	Staff Room	NAD
FPB-37A	**9"x9" Black Floor Tile with White Streaks**	**Staff Closet**	**3% Chrysotile**
FPB-37B	Black Mastic	Staff Closet	NAD
FPB-38A	**9"x9" Black Floor Tile with White Streaks**	**Staff Closet**	**3% Chrysotile**
FPB-38B	Black Mastic	Staff Closet	NAD
FPB-39A	Joint Compound	Kitchen	NAD
FPB-39B	Drywall	Kitchen	NAD
FPB-40A	12"x12" Tan Floor Tile	Kitchen	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-40B	Yellow Mastic	Kitchen	NAD
FPB-40C	Gray Leveling Compound	Kitchen	NAD
FPB-40D	Black Mastic	Kitchen	NAD
FPB-41A	12"x12" Tan Floor Tile	Kitchen	NAD
FPB-41B	Yellow Mastic	Kitchen	NAD
FPB-41C	Gray Leveling Compound	Kitchen	NAD
FPB-41D	Black Mastic	Kitchen	NAD
FPB-42	Brown Cove Base Mastic	Kitchen	NAD
FPB-43	Brown Cove Base Mastic	Hall	NAD
FPB-44	**Black Sink Insulation**	**Kitchen**	**3% Chrysotile**
FPB-45	2'x4' Divot and Dot Ceiling Tile	Staff Room	NAD
FPB-46A	Plaster-White Skim Coat	Staff Room	NAD
FPB-46B	Plaster-Tan Base Coat	Staff Room	NAD
FPB-47	2'x4' Divot and Dot Ceiling Tile	Hall Lower Level	NAD
FPB-48A	**9"x9" Brown Floor Tile**	**Storage Lower Lever**	**3% Chrysotile**
FPB-48B	**Black Mastic**	**Storage Lower Lever**	**2% Chrysotile**
FPB-48C	Tan Cementitious Material	Storage Lower Lever	NAD
FPB-49A	**9"x9" Brown Floor Tile**	**Storage Lower Lever**	**3% Chrysotile**
FPB-49B	**Black Mastic**	**Storage Lower Lever**	**2% Chrysotile**
FPB-50A	12"x12" Orange Floor Tile	Storage Lower Lever	NAD
FPB-50B	**Black Mastic**	**Storage Lower Lever**	**3% Chrysotile**
FPB-51A	12"x12" Orange Floor Tile	Storage Lower Lever	NAD
FPB-51B	**Black Mastic**	**Storage Lower Lever**	**3% Chrysotile**

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-52A	12"x12" Green Floor Tile	Multi-Purpose Room Lower Level	NAD
FPB-52B	Tan Mastic	Multi-Purpose Room Lower Level	NAD
FPB-52C	**Black Mastic**	**Multi-Purpose Room Lower Level**	**4% Chrysotile**
FPB-53A	12"x12" Green Floor Tile	Multi-Purpose Room Lower Level	NAD
FPB-53B	Tan Mastic	Multi-Purpose Room Lower Level	NAD
FPB-53C	White Leveling Compound	Multi-Purpose Room Lower Level	NAD
FPB-54	Grout with 4"x4" Terra Cotta Tile	Multi-Purpose Room Lower Level	NAD
FPB-55A	Joint Compound	Multi-Purpose Room Lower Level	NAD
FPB-55B	Drywall	Multi-Purpose Room Lower Level	NAD
FPB-56A	12"x12" Pink Floor Tile	Lower Lever Staff Rest Room	NAD
FPB-56B	Tan Mastic	Lower Lever Staff Rest Room	NAD
FPB-56C	**Black Mastic**	**Lower Lever Staff Rest Room**	**3% Chrysotile**
FPB-57A	12"x12" Pink Floor Tile	Lower Lever Staff Rest Room	NAD
FPB-57B	Tan Mastic	Lower Lever Staff Rest Room	NAD
FPB-57C	**Black Mastic**	**Lower Lever Staff Rest Room**	**3% Chrysotile**
FPB-58A	Tan Decorative Wall	Lower Lever Staff Rest Room	NAD
FPB-58B	Plaster-White Skim Coat	Lower Lever Staff Rest Room	NAD
FPB-59	Tan Decorative Plaster Wall	Lower Lever Staff Rest Room	NAD
FPB-60	Tan Decorative Plaster Wall	Lower Lever Staff Rest Room	NAD
FPB-61A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-61B	Tan Brick	Hall/Stairs Lower Level	NAD
FPB-62A	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-62B	Drywall	Multi-Purpose Room Storage	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-63	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-64	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-65	Exterior Window Glazing Compound	Exterior	NAD
FPB-66	Exterior Window Glazing Compound	Exterior	NAD
FPB-67	**Exterior Window Caulk**	**Exterior**	**3% Chrysotile**
FPB-68	Black Door Caulk	Exterior	NAD
FPB-69	**Exterior Window Caulk**	**Exterior**	**3% Chrysotile**
FPB-70	Exterior Window Glazing Compound	Exterior	NAD
FPB-71	**White Caulk on Vent**	**Exterior**	**3% Chrysotile**
FPB-72A	Gray Expansion Joint Mastic	Exterior	NAD
FPB-72B	**Tan Expansion Joint Mastic**	**Exterior**	**2% Chrysotile**
FPB-73	**White Façade Mastic**	**Exterior**	**3% Chrysotile**
FPB-74	**Exterior Window Caulk**	**Exterior/Boiler Room**	**3% Chrysotile**
FPB-75	**White Façade Mastic**	**Exterior**	**3% Chrysotile**
FPB-76	Gray Expansion Joint Mastic	Exterior	NAD

* NAD – No Asbestos Detected. Bold type indicates an asbestos-containing material.

Testing for asbestos confirmed the presence of asbestos-containing materials including:

- 9"x9" floor tile of various colors located throughout the lower level,
- Floor tile mastic associated with 12"x12" Floor Tile throughout the lower level,
- Black sink insulation,
- Exterior window caulk,
- Exterior vent caulk,
- Exterior expansion joint mastic, and
- Exterior façade mastic.

Assumed materials included:

- Fire doors,

- Mirror mastic in restrooms,
- Roofing materials.

Limitations: Suspect asbestos-containing materials were not sampled if they were located behind solid walls and ceilings, or in enclosed pipe chases that would have to be damaged to access the suspect building materials. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground. The roof was not sampled to accessibility issues. All roofing materials will be assumed positive until sampled and proven otherwise.

B. Lead

A lead-based paint survey was not performed, however, based upon the age of the structure and the presence of interior and exterior painted wood, plaster and drywall surfaces, lead-paint is likely present. Furthermore, the building is considered a child occupied facility and will require compliance with the OSHA Lead in Construction Standard, Maryland Reduction of Lead Risk in Housing, and Lead Renovation Repair and Painting Rules.

C. Polychlorinated Biphenyls

Fluorescent lamp ballasts were identified to be present in the building. A representative number of fluorescent light ballasts should be inspected for the presence or absence of the "No PCBs" label. If the "No PCBs" label is absent, then the ballast is considered to contain PCBs. The number of ballasts was estimated based upon the type of light fixture observed in the building.

D. Mercury

Two-foot and 4-foot fluorescent lamps were identified in the building. Further investigation to obtain accurate counts will be required because disposal of fluorescent light tubes is regulated under the EPA Universal Waste rule.

E. Refrigerants

No equipment containing refrigerants were identified at the library.

F. Other Universal and Regulated Waste

The survey for hazardous materials indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to demolition activities on the building. Those materials could include:

- Emergency lights which contain a battery
- Exit signs which contain a battery, and
- Automatic door closers which contain oil,

V. CONCLUSIONS

The survey for hazardous materials at the Forest Park Branch Library, located in Baltimore, Maryland indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to proposed demolition. The survey for hazardous materials included all accessible spaces of the interior and exterior of the library.

Asbestos: Asbestos-containing materials identified through sampling and analysis, and those materials that are presumed without testing to contain asbestos are:

- 9"x9" floor title of various colors throughout the lower level
- Mastic associated with 12"x12" throughout the lower level
- Black sink insulation
- Exterior window caulk
- Exterior vent caulk
- Exterior expansion joint mastic
- Exterior façade mastic
- Wood Doors (Assumed)
- Mirror Masic (Assumed)
- Roofing Materials (Assumed)

According to the USEPA National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations, all friable asbestos-containing materials and those materials likely to become friable during renovation must be removed by a licensed asbestos abatement contractor.

Lead: Lead paint is likely present due to the age of the building. A lead-based paint survey was not conducted, but it is recommended to be performed prior to any demolition or renovations intended for this building.

The information contained within this report is intended to address the presence of lead-based paint to ensure worker protection requirements are met under the Occupational Safety and Health Administration's (OSHA) "Lead in Construction Rule (29 CFR 1926.62)." The presence of lead-containing substances is presumed in any residential building construction before 1978 and in all commercial, industrial, and public structures unless it is determined that all painted surfaces are lead-free. According to the OSHA Lead in Construction regulation, lead may still be present and hazardous lead exposures might result from the disturbance of painted surfaces that have below the definition of lead-based paint (i.e. <0.7 mg/cm^2 or 0.5% lead by weight) for lead-based paint. Furthermore, lead may be present in waste materials at concentrations that would cause the waste to be considered hazardous per the Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA).

Recommendations: The survey for hazardous materials at 610 Ruthsburg Road indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to renovation or demolition. Our recommendations are summarized below:

1. Remove and dispose of all asbestos-containing 9"x9" floor tiles identified at various locations throughout the lower level (staff area) of the library.
2. Remove and dispose of asbestos-containing black sink insulation identified in the kitchen/break room of the library.
3. Remove and dispose of all asbestos-containing black mastic identified in association of 12"x12" floor tile located throughout the lower level of the library.
4. Remove and dispose of asbestos-containing exterior window caulk from all windows.
5. Remove and dispose of asbestos-containing exterior vent caulk.
6. Remove and dispose of asbestos-containing exterior expansion joint mastic.
7. Remove and dispose of asbestos-containing exterior façade mastic.
8. Sample and analyze or remove mirror mastic as assumed asbestos containing materials.
9. Sample and analyze or remove roofing as assumed asbestos containing materials.
10. Sample and analyze or remove fire doors as assumed asbestos containing materials.

11. Remove and dispose of battery-containing lighted exit signs and emergency lights as universal waste.
12. Remove and dispose of oil-containing automatic door closers.
13. Inspect fluorescent lamp ballasts for a "no PCBs" label. Dispose of any that DO NOT have this label as PCB-containing waste.
14. Remove and dispose of fluorescent lamps, compact fluorescent bulbs and incandescent bulbs as universal waste.
15. Materials may be concealed behind solid walls, ceilings or in pipe chases. Demolition activities have the potential to expose additional asbestos-containing materials. Caution should be taken while demolishing solid ceilings and walls.
16. Lead-based paint was not surveyed but is expected to be present, due to the age of the facility. It is highly recommended that a full lead-based paint survey is performed. Any disturbance to painted surfaces that contain any detectable levels of lead should be performed in accordance with OSHA "Lead in Construction Rule (29 CFR 1926.62)" and the Lead Renovation, Repair and Painting Rule. Waste should be analyzed by toxicity characteristic leaching procedure (TCLP).

VI. Limitations

This report has been prepared for the exclusive use of the Maryland Department of Transportation, State Highway Administration and/or their agents. This service has been performed in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made. Our conclusions and recommendations are based, in part, upon information provided to us by others and our site observations. We have not verified the completeness or accuracy of the information provided to us by others, unless otherwise noted. Our observations and recommendations are based upon conditions readily visible at the site at the time of our site visit, and upon current industry standards. No observations were made behind solid walls, ceilings or in pipe chases. The report presents assumptions for the existence of hazardous materials in these locations.

By virtue of providing the services described in this report, the preparer does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential danger to public health, safety, or the environment. It is the Client's responsibility to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety, or the environment. Under this scope of services, the preparer assumes no responsibility regarding response actions (e.g. O&M plan, encapsulation, abatement, removal, etc.) initiated as a result of these findings. Response actions are the sole responsibility of the Client and should be conducted in accordance with local, sate, and/or federal requirements, and should be performed by appropriately licensed personnel as warranted.

Attachment A

Inspector's Credentials

Asbestos Accreditation



Julia Fafard
Name

Signature

IMP Review
Course Title

230004825

Exam Date: 10/24/2023
Course Date: 10/10/2023
Exp Date: 10/10/2024

STATE OF MARYLAND

Attachment B

Asbestos Certificates of Analysis and Chain-of-Custody Forms

SEEML Reference Number:
G-240531105
Date Issued: 05/31/2024

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
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Asbestos Analytical Report By: Polarized Light Microscopy

This report has been prepared for **ARIA Environmental** the information and data has been checked for thoroughness and accuracy. The results reported apply only to the materials as received. The documents(s) contained herein are confidential and privileged information intended for the exclusive use of the individual or entity named above. This report shall not be reproduced except in full without SEEML's approval.

Client Project Name: Forest Park Branch Library
The Following report was prepared using this test method(s) contained within this document.

- [x] PLM Bulk Asbestos Fiber Analysis:EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples
- [ ] PLM 400 Point Count (<0.25%) EPA 600/R-93/116
- [ ] PLM 1000 Point Count (<0.1%) EPA 600/R-93/116
- [ ] PLM Carb 435 Level A Reporting Limit (<0.25%)
- [ ] PLM Carb 435 Level B (Reporting limit <0.1%)
- [ ] PLM by EPA/600/R-93/116 with Milling Prep 400 Point Count
- [ ] PLM Vermiculite Initial Screening EPA 600R-93/116
- [ ] PLM Cincinnati Method 600/R-04/004 (Amphibole Only)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 1 Chrysotile & Prep)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 2 (Amphibole)

Approved By : *Andrea Berrios*

Thank you for choosing SEEML Labs. We strive to provide superior quality testing, analytical data and customer service. SEEML is accredited through the National Institute of Standards and Technology (NIST) National Voluntary Accreditation Program (NVLAP) for bulk asbestos analysis NVLAP # 201031-0 and licensed by the Texas Department of State Health Services (License Number: 300474). This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
392A / FPB-01	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Main Room- Yellow Glue
393A / FPB-02	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Main Room- Yellow Glue
394A / FPB-03	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Main Room- Plaster
394B / FPB-03	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/Main Room- Plaster
395A / FPB-04	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Entrance to Children's Section- Plaster
395B / FPB-04	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/Entrance to Children's Section- Plaster
396A / FPB-05	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Entrance to Children's Section- DW/ JC
396B / FPB-05	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Entrance to Children's Section- DW/ JC
397A / FPB-06	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/At Adult Section- Plaster

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PLM Asbestos Bulk Sample Summary

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		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
397B / FPB-06	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/At Adult Section- Plaster
398A / FPB-07	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Server Room- DW/ JC
398B / FPB-07	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Server Room- DW/ JC
398C / FPB-07	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Server Room- DW/ JC
399A / FPB-08	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Acoustical Wall Tile 1'x1'
400A / FPB-09	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Acoustical Wall Tile 1'x1'
401A / FPB-10	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Brown Mastic Patty
401B / FPB-10	**None Detected**	3% Talc	97% Organic Matrix	(Brown) Mastic/Children's Section- Brown Mastic Patty
402A / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound

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PLM Asbestos Bulk Sample Summary

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		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
402B / FPB-11	**None Detected**	2% Cellulose	98% Gypsum	(Gray) Plaster/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
402C / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Orange) Flooor Tile/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
402D / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
403A / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
403B / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
403C / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
404A / FPB-13	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Server Room- Brown Mastic Patty
404B / FPB-13	**None Detected**	2% Talc	98% Organic Matrix	(Brown) Mastic/Server Room- Brown Mastic Patty
405A / FPB-14	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Entrance to Adult Section- Leveling Compound

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PLM Asbestos Bulk Sample Summary

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		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
405B / FPB-14	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Adult Section- Leveling Compound
406A / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
406B / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
406C / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
407A / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
407B / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
407C / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
408A / FPB-17	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Employee RR-Plaster
408B / FPB-17	**None Detected**	2% Cellulose	98% Gypsum	(Tan) Granular Plaster/Employee RR-Plaster

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PLM Asbestos Bulk Sample Summary

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		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
409A / FPB-18	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Stairwell- Plaster
409B / FPB-18	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Stairwell- Plaster
409C / FPB-18	**None Detected**	2% Cellulose	98% Gypsum	(Brown) Granular Plaster/Stairwell-Plaster
410A / FPB-19	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Grout/Employee RR- Plaster
411A / FPB-20	**None Detected**	None Detected	100% Organic Matrix	(White) Floor Tile/Public RR- 12"x12" White FT/ Mastic
411B / FPB-20	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Public RR- 12"x12" White FT/ Mastic
412A / FPB-21	**None Detected**	None Detected	100% Organic Matrix	(White) Floor Tile/Public RR- 12"x12" White FT/ Mastic
412B / FPB-21	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Public RR- 12"x12" White FT/ Mastic
413A / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Brown) Floor Tile/Side Entry Vestibule-12"x12" FT/Mastic

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Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
413B / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
413C / FPB-22	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Side Entry Vestibule- 12"x12" FT/Mastic
413D / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Off-White) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
414A / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Brown) Floor Tile/Side Entry Vestibule-12"x12" FT/Mastic
414B / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
414C / FPB-23	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Side Entry Vestibule- 12"x12" FT/Mastic
414D / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Off-White) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
415A / FPB-24	**None Detected**	None Detected	100% Carbon/Quartz	(Black) Grout/Main Entry Vestibule-Grout with 4'x4' Terra Cotta Tile
416A / FPB-25	**None Detected**	None Detected	100% Organic Matrix	(White) Caulk/Public RR- Toilet Caulk

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Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
417A / FPB-26	**None Detected**	None Detected	100% Organic Matrix	(White) Caulk/Employee RR- Toilet Caulk
418A / FPB-27	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Public RR- DW/JC
418B / FPB-27	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Public RR- DW/JC
419A / FPB-28	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Hall/ Stairs LL- Black Waterproofing on Brick
419B / FPB-28	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Brick/Hall/ Stairs LL- Black Waterproofing on Brick
420A / FPB-29	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Hall/ Stairs LL- Black Waterproofing on Brick
420B / FPB-29	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Brick/Hall/ Stairs LL- Black Waterproofing on Brick
421A / FPB-30	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Work Area- Plaster
421B / FPB-30	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Work Area- Plaster

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		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
421C / FPB-30	**None Detected**	2% Cellulose	98% Gypsum	(Tan) Granular Plaster/Work Area-Plaster
422A / FPB-31	**None Detected**	None Detected	100% Organic Matrix	(Tan) Sealant/Boiler Room- Flange Sealant
423A / FPB-32	**None Detected**	None Detected	100% Organic Matrix	(Tan) Sealant/Boiler Room- Flange Sealant
424A / FPB-33	**None Detected**	70% Cellulose	30% Organic Matrix	(Yellow) Tape/Boiler Room- Tape/ Mastic on Duct
425A / FPB-34	**None Detected**	70% Cellulose	30% Organic Matrix	(Yellow) Tape/Boiler Room- Tape/ Mastic on Duct
425B / FPB-34	**None Detected**	None Detected	100% Organic Matrix	(White) Mastic/Boiler Room- Tape/ Mastic on Duct
426A / FPB-35	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
426B / FPB-35	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Floor Tile/Staff- Black FT/ Mastic/ Carpet Mastic
426C / FPB-35	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic

Approved By: Andrea Berrios

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
427A FPB-36	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
427B FPB-36	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Floor Tile/Staff- Black FT/ Mastic/ Carpet Mastic
427C FPB-36	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
428A FPB-37	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Floor Tile/Closet- 9'x9' Black FT w White Streaks/ Mastic
428B FPB-37	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Closet- 9'x9' Black FT w White Streaks/ Mastic
429A FPB-38	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Floor Tile/Closet- 9'x9' Black FT w White Streaks/ Mastic
429B FPB-38	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Closet- 9'x9' Black FT w White Streaks/ Mastic
430A FPB-39	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Kitchen- DW/ JC
430B FPB-39	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Kitchen- DW/ JC

Approved By: Andrea Berrios

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
431A / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Tan) Floor Tile/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431B / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431C / FPB-40	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Leveling Compound/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431D / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Black) Matic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432A / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Tan) Floor Tile/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432B / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432C / FPB-41	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Leveling Compound/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432D / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
433A / FPB-42	**None Detected**	3% Wollastonite	97% Organic Matrix	(Brown) Mastic/Kitchen- Brown Covebase Mastic

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PLM Asbestos Bulk Sample Summary

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		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
434A / FPB-43	**None Detected**	3% Wollastonite	97% Organic Matrix	(Brown) Mastic/Kitchen- Brown Covebase Mastic
435A / FPB-44	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Sink Undercoat/Kitchen- Black Sink Insulation
436A / FPB-45	**None Detected**	5% Fiberglass,85% Cellulose	5% Binder/Filler,5% Perlite	(Tan) Ceiling Tile/Staff- 2'x4' Divot and Dot Ceiling Tile
437A / FPB-46	**None Detected**	None Detected	100% Gypsum	(White) Skimcoat/Staff- Plaster Ceiling
437B / FPB-46	**None Detected**	2% Animal Hair	98% Gypsum	(Tan) Granular Plaster/Staff- Plaster Ceiling
438A / FPB-47	**None Detected**	20% Fiberglass,65% Cellulose	10% Perlite,5% Binder/Filler	(White) Ceiling Tile/Hall- 2x4' Divot and Dot Ceiling Tile
439A / FPB-48	**3% Chrysotile**	None Detected	97% Organic Matrix	(Brown) Floor Tile/Storage- 9"x9" Brown FT/ Mastic
439B / FPB-48	**2% Chrysotile**	None Detected	98% Organic Matrix	(Black) Mastic/Storage- 9"x9" Brown FT/ Mastic
439C / FPB-48	**None Detected**	None Detected	100% Gypsum	(Tan) Cementitious Material/Storage- 9"x9" Brown FT/ Mastic

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
440A / FPB-49	**3% Chrysotile**	None Detected	97% Organic Matrix	(Brown) Floor Tile/Storage- 9"x9" Brown FT/ Mastic
440B / FPB-49	**2% Chrysotile**	None Detected	98% Organic Matrix	(Black) Mastic/Storage- 9"x9" Brown FT/ Mastic
441A / FPB-50	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Storage- 12"x12" Orange FT/ Mastic
441B / FPB-50	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/Storage- 12"x12" Orange FT/ Mastic
442A / FPB-51	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Storage- 12"x12" Orange FT/ Mastic
442B / FPB-51	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/Storage- 12"x12" Orange FT/ Mastic
443A / FPB-52	**None Detected**	None Detected	100% Organic Matrix	(Green) Floor Tile/Multi- Purpose Room- 12"x12" Green FT/ Mastic
443B / FPB-52	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic
443C / FPB-52	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
444A / FPB-53	**None Detected**	None Detected	100% Organic Matrix	(Green) Floor Tile/Multi- Purpose Room- 12"x12" Green FT/ Mastic
444B / FPB-53	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic
444C / FPB-53	**None Detected**	None Detected	100% Binder/Filler	(White) Leveling Compound/Multi- Purpose Room- 12"x12" Green FT/ Mastic
445A / FPB-54	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Grout/Multi- Purpose Room- Grout 4"x4" Terra Cotta Tile
446A / FPB-55	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Multi- Purpose Room- DW/ JC
446B / FPB-55	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Multi- Purpose Room- DW/ JC
447A / FPB-56	**None Detected**	None Detected	100% Organic Matrix	(Pink) Floor Tile/LL Staff RR- 12"x12" Pink FT/ Mastic
447B / FPB-56	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
447C / FPB-56	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic

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PLM Asbestos Bulk Sample Summary

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		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
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		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
448A / FPB-57	**None Detected**	None Detected	100% Organic Matrix	(Pink) Floor Tile/LL Staff RR- 12"x12" Pink FT/ Mastic
448B / FPB-57	**None Detected**	3% Cellulose	97% Organic Matrix	(Tan) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
448C / FPB-57	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
449A / FPB-58	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
449B / FPB-58	**None Detected**	None Detected	100% Gypsum	(White) Plaster/LL Staff RR- Decorative Plaster Wall
450A / FPB-59	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
451A / FPB-60	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
452A / FPB-61	**None Detected**	None Detected	100% Organic Matrix	(Black) Water Proofing/Hall Stairs- Black Waterproofing on Brick
452B / FPB-61	**None Detected**	None Detected	100% Carbon/Quartz	(Tan) Brick/Hall Stairs- Black Waterproofing on Brick

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
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		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
453A / FPB-62	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
453B / FPB-62	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Multi- Purpose Storage-Decorative Coating on DW
454A / FPB-63	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
455A / FPB-64	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
456A / FPB-65	**None Detected**	None Detected	100% Organic Matrix	(White) Glazing/Exterior- Exterior Window Glazing Compound
457A / FPB-66	**None Detected**	None Detected	100% Binder/Filler	(White) Glazing/Exterior- Exterior Window Caulk
458A / FPB-67	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- Exterior Window Caulk
459A / FPB-68	**None Detected**	None Detected	100% Organic Matrix	(Black) Caulk/Exterior- Back Door Caulk
460A / FPB-69	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- Exterior Window Caulk

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Southeast Environmental Microbiology Laboratories - Asbestos Division
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Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
461A / FPB-70	**None Detected**	None Detected	100% Binder/Filler	(White) Glazing/Exterior- Exterior Window Glazing Compound
462A / FPB-71	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Caulk on Vent
463A / FPB-72	**None Detected**	None Detected	100% Organic Matrix	(Gray) Mastic/Exterior- Gray Expansion Joint
463B / FPB-72	**2% Chrysotile**	None Detected	98% Binder/Filler	(Tan) Compound/Exterior- Gray Expansion Joint
464A / FPB-73	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Facade Mastic
465A / FPB-74	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior/ Boiler Room- Exterior Window Caulk
466A / FPB-75	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Facade Mastic
467A / FPB-76	**None Detected**	None Detected	100% Organic Matrix	(Gray) Mastic/Exterior- Gray Expansion Joint Mastic

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
Any opinions/interpretations expressed in this report are outside the scope of this laboratory's accreditation. Interpretation of the data and information within this document is left to the company, consultant, and/or persons who conducted the fieldwork. A material is considered regulated asbestos containing material (ACM) where the asbestos content is determined to be one percent or greater. Several organizations, including the American Conference of Government Industrial Hygienists (ACGIH); the American Industrial Hygiene Association (AIHA); the Indoor Air Quality Association (IAQA); the United States Environmental Protection Agency (USEPA); the Centers for Disease Control (CDC) as well as the California Department of Health Services (CADHS) have published guidelines for assessment and interpretation of analytical data indicating a tested material is ACM.

SEEML Labs
Analytical Solutions For a Healthy Indoor Environment

Southeast Environmental Microbiology Laboratories AKA- SEEML Labs

Chain of Custody- 102 Edinburgh Ct., Greenville, SC 29607; Phone: 864-233-3770; www.seeml.com

Company:	ARIA Environmental	**Contact Person:**	**Brian Sciorilli**
Email:	bsciorilli@ariaenviro.com	**Phone:**	**443-864-2813**
Project Name/ Number:	**Forest Park Branch Library**	**Date Sampled:**	5/30/24
Project Address, City, State, Zip:	3023 Garrison Boulevard Baltimore, MD		

Requested Services

Mold/Bacteria Analysis

*Mold Air - Spore Trap	*Non-Fungal Particulate Air - Spore Trap	Mold Direct t- Swab, Tape, Bulk	**Culturable Mold – Swab, Bulk, *Air	***Total Coliform, *E. coli* (Presence /Absence)

Asbestos Analysis

***Sewage Assessment (Presence/ Absence)	PLM 600-R-93-116 (<1%)	PLM 600-R-93-116 (<1%) With Gravimetric	PLM Point Count 400 (<0.25%)	PLM Point Count 1000 (0.1%)	PLM CARB 435	Cincinnati Method EPA 600/R-04/004 by PLM	*PCM	Positive Stop	Hard Stop

Other

TEM	Lead (Pb), *Lead Air	Other: Specify:

Required Turnaround Time:

- ☐ Rush
- ☒ Same Business Day
- ☐ Next Business Day
- ☐ Two Business Days
- ☐ Three Business Days
- ☐ Five Business Days
- ☐ Other-Specify in Notes

Check Appropriate Test. Please note asbestos positive stops need to be checked above the notes section of the COC. *Volume is pump setting (L/min.) X minutes ran. ** Area is only required for culturable surface samples. ***Needed for bacterial samples.

Client Sample ID:	Sample Location/Description	*Volume	**Area	***Time Collected	Mold/Bacteria Analysis					Asbestos Analysis									Other		
	Sample Sheet Attached				☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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Inspector Notes/Special Instructions:

All Samples PLM

Relinquished By:	John Rhea	**Received By:**		**Samples Acceptable?** ☐ YES ☐ NO	**SEEML Reference Number:** G-240531105
Date/Time:	5/30/24 / 3:30 pm	**Date/ Time:**			**SEEML Lab ID:** 392-467

G-240531P5
392-467

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-01	Yellow Carpet Glue	Main Room	
FPB-02	Yellow Carpet Glue	Main Room	
FPB-03	Plaster	Main Room	
FPB-04	Plaster	Entrance to Children's Section	
FPB-05	Drywall Joint Compound	Entrance to Children's Section	
FPB-06	Plaster	At Adult Section	
FPB-07	Drywall Joint Compound	Server Room	
FPB-08	Acoustical Wall Tile 1'x1'	Children's Section	
FPB-09	Acoustical Wall Tile 1'x1'	Children's Section	
FPB-10	Brown Mastic Patty	Children's Section	
FPB-11	12"x12" Orange FT/Mastic Leveling Compound	Entrance to Children's Section	
FPB-12	12"x12" Orange FT/Mastic/ Carpet Mastic	Entrance to Children's Section	
FPB-13	Brown Mastic Patty	Server Room	
FPB-14	Leveling compound	Entrance to Adult Section	
FPB-15	12"x12" Orange FT/Mastic/ Carpet Mastic	Entrance to Adult Section	
FPB-16	12"x12" Orange FT/Mastic/ Carpet Mastic	Adult Section	
FPB-17	Plaster	Employee RR	
FPB-18	Plaster	Stairwell	
FPB-19	Grout with 12"x12" Ceramic Tile	Employee RR	
FPB-20	12"x12" White FT/Mastic	Public RR	
FPB-21	12"x12" White FT/Mastic	Public RR	
FPB-22	12"x12" FT/Mastic	Side Entry Vestibule	Color unknown
FPB-23	12"x12" FT/Mastic	Side Entry Vestibule	Color unknown

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-24	Grout with 4"x4" Terra Cotta Tile	Main Entry Vestibule	
FPB-25	Toilet Caulk	Public RR	
FPB-26	Toilet Caulk	Employee RR	
FPB-27	Drywall Joint Compound	Public RR	
FPB-28	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-29	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-30	Plaster	Work Area	
FPB-31	Flange Sealant	Boiler Room	
FPB-32	Flange Sealant	Boiler Room	
FPB-33	Tape/Mastic on Duct	Boiler Room	
FPB-34	Tape/Mastic on Duct	Boiler Room	
FPB-35	Black FT/Mastic/Carpet Mastic	Staff	
FPB-36	Black FT/Mastic/Carpet Mastic	Staff	
FPB-37	9"x9" Black FT with White Streaks/Mastic	Closet	
FPB-38	9"x9" Black FT with White Streaks/Mastic	Closet	
FPB-39	Drywall Joint Compound	Kitchen	
FPB-40	12"x12" White FT/Mastic/Leveling Compound	Kitchen	
FPB-41	12"x12" White FT/Mastic/Leveling Compound	Kitchen	
FPB-42	Brown Cove Base Mastic	Kitchen	
FPB-43	Brown Cove Base Mastic	Hall	
FPB-44	Black Sink Insulation	Kitchen	
FPB-45	2'x4' Divot and Dot Ceiling Tile	Staff	

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-46	Plaster ceiling	Staff	
FPB-47	2'x4' Divot and Dot Ceiling Tile	Hall	
FPB-48	9"x9" Brown FT/Mastic	Storage	
FPB-49	9"x9" Brown FT/Mastic	Storage	
FPB-50	12"x12" Orange FT/Mastic	Storage	
FPB-51	12"x12" Orange FT/Mastic	Storage	
FPB-52	12"x12" Green FT/Mastic	Multi-Purpose Room	
FPB-53	12"x12" Green FT/Mastic	Multi-Purpose Room	
FPB-54	Grout with 4"x4" Terra Cotta Tile	Multi-Purpose Room	
FPB-55	Drywall Joint Compound	Multi-Purpose Room	
FPB-56	12"x12" Pink FT/Mastic	LL Staff RR	
FPB-57	12"x12" Pink FT/Mastic	LL Staff RR	
FPB-58	Decorative Plaster Wall	LL Staff RR	
FPB-59	Decorative Plaster Wall	LL Staff RR	
FPB-60	Decorative Plaster Wall	LL Staff RR	
FPB-61	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-62	Decorative coating on DW	Multi-purpose Storage	
FPB-63	Decorative coating on DW	Multi-purpose Storage	
FPB-64	Decorative coating on DW	Multi-purpose Storage	
FPB-65	Exterior Window Glazing Compound	Exterior	
FPB-66	Exterior Window Glazing Compound	Exterior	
FPB-67	Exterior Window Caulk	Exterior	
FPB-68	Black Door Caulk	Exterior	

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-69	Exterior Window Caulk	Exterior	
FPB-70	Exterior Window Glazing Compound	Exterior	
FPB-71	White Caulk on Vent	Exterior	
FPB-72	Gray Expansion Joint Mastic	Exterior	
FPB-73	White Façade Mastic	Exterior	
FPB-74	Exterior Window Caulk	Exterior/Boiler Room	
FPB-75	White Façade Mastic	Exterior	
FPB-76	Gray Expansion Joint Mastic	Exterior	

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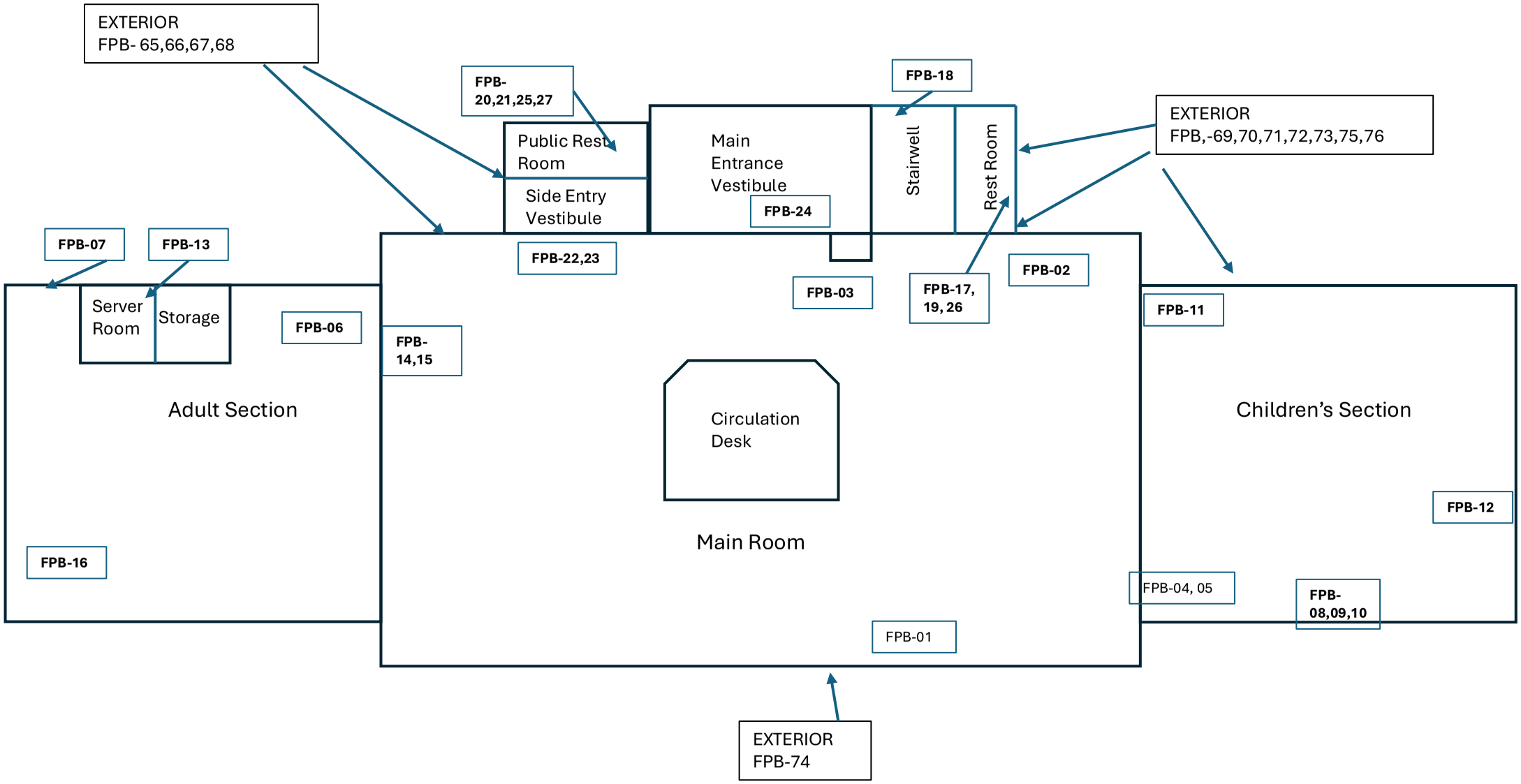
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Sample Location Plan

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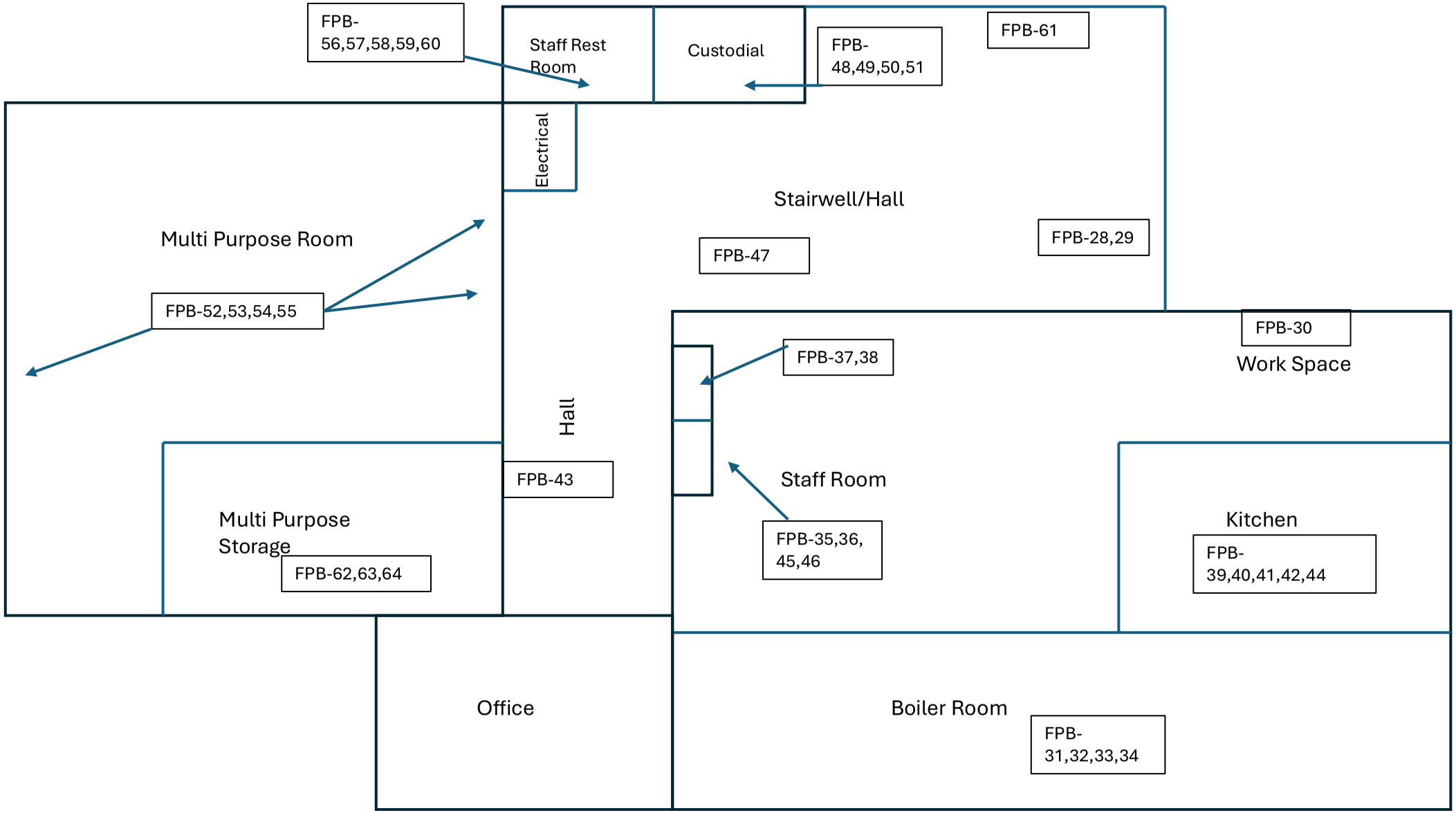
Enoch Pratt Free Library Forest Park Branch

Sample Location Drawing – Main Level



Enoch Pratt Free Library Forest Park Branch

Sample Location Drawing – Lower Level



DOCUMENT 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Contractor's use of site and premises.
4. Work restrictions.
5. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Enoch Pratt Free Library – Forest Park Branch Library.

1. Project Location: 3023 Garrison Blvd., Baltimore, Maryland 21216.

B. Owner: The City of Baltimore, Maryland
Baltimore Department of General Services
Capital Projects Division
200 N. Holliday Street
Baltimore, MD 21202

1. Owner's Representative: Jackson Gilman-Forlini, (443) 271-5350, jackson.gilman-forlini@baltimorecity.gov

C. Architect of Record: Prime AE Group. Inc.

1. Architect's Representative: Steven Schwartzman, AIA, LEED AP, (410) 807-8286, steven.schwartzman@primeeng.com

D. Design Architect: HBM Architects, LLC

1. Architect's Representative: Katie Gaukin, (216)241-1100, kgaukin@hbmarchitects.com.

E. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Landscape Architect: Floura Teeter Landscape Architects.

   a. Landscape Architect's Representative: Jon Gemmell, PLA, (410)528-8395, jgemmell@flourateeter.com.

2. Structural Engineer: Columbia Engineering.

   a. Structural Engineer's Representative: Josh Clayton, (410)992-9970 x109, jclayton@columbiaengineering.com.

3. Mechanical and Plumbing Engineering: Burdette, Koehler, Murphy & Associates, Inc.

   a. Engineer's Representative: Drew Petrella, PE, LEED AP BD+C, (443)921-8727, dpetrella@bkma.com.

4. Electrical Engineering: MIN Engineering, Inc.

   a. Engineer's Representative: Mewael Yebassew, (410)486-4692, myebassew@minengineering.com.

5. Civil Engineering: MK Engineering.

   a. Engineer's Representative: Ryan Pike, PE, (667) 210-2485, rpike@mkceng.com.

6. Industrial Hygiene & Safety: Aria Environmental, Inc.

   a. Representative: Brian Sciorilli, (410)549-5774, bsciorilli@ariaenviro.com.

7. Commissioning: Sustainable Building Partners, LLC.

   a. Representative: Ashley Rice, (703)970-2890 x 235 ashley.rice@sustainbldgs.com.

8. Survey: Precision Survey and Mapping, LLC.

   a. 410-459-2124

9. Geotechnical Engineering: D. W. Kozera, Inc.

   a. Engineer's Representative: Josh Latham, PE (410)823-1060, jlatham@dwkozera.com.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The Enoch Pratt Free Library's Forest Park Branch, opened in 1910 with additions and renovations in 1954 and 1987, is an approximately 8,221 GSF building with a 909 GSF addition as part of this project. The existing building and the addition is a mixed use of A-3 (Assembly), B (Business), S-1 (Moderate-hazard Storage) and S-2 (Low-Hazard Storage) occupancies with the A-3 being the controlling use. The new construction is construction classification type VB Unprotected.

2. The project's scope includes:
   a. Demolition of interior fixtures and finishes.
   b. Hazardous material abatement.
   c. New addition including restrooms and vertical transportation.
   d. Reconfiguration of the Library's, new mechanical, plumbing and electrical systems.
   e. Replacement of existing exterior wall fenestrations.
   f. Repair and restoration of portions of the exterior façade.
   g. New or revised utilities.
   h. New exterior landscaping and hardscape.
   i. Other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of as required by the Authority Having Jurisdiction, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner and local jurisdiction as required not less than two weeks in advance of proposed utility interruptions.
2. Obtain Owner's and local jurisdiction written permission, permits etc. before proceeding with utility interruptions.

D. Smoking and Controlled Substance Restrictions: Use of tobacco products**,** alcoholic beverages, and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Comply with the provisions regarding specifications and Drawings in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:
1. 011115.10 Explanation of Drawings and Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.

3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

C. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

D. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

E. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.

1.2 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.3 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes**,** freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the allowance.

1.5 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $72,500. Include construction of Electrical Duct Bank from approximately mid-block of Springdale Avenue to Callaway Avenue and down to Forest Park Library, a distance of approximately 725 LF. Construction Documentation will be provided at a future date.
1. This allowance includes MOT, material cost, labor, and installation and Contractor overhead and profit.

B. Allowance No. 2: Lump-Sum Allowance: Include the sum of $3,500 for permit fees to pull the Permit for Construction work.

1. This allowance includes the primary construction permit as calculated by the Baltimore City Department of Housing and Community Development.

2. Trade permits, inspections, and other miscellaneous permits are not included within this allowance.

END OF SECTION 012100

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Repoint all existing brick.

1. Base Bid: Repoint existing brick as indicated on Drawings AD1.10 and AD1.11 as specified in Section 042000 "Historic Brick Unit Masonry Repointing."
2. Alternate: Repoint all remaining existing brick not indicated on Drawings AD1.10 and AD1.11 as specified in Section 042000 "Historic Brick Unit Masonry Repointing."

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 20 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 or form agreed upon with Owner.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or form agreed upon with owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 012600 "Contract Modification Procedures."
   2. Comply with the provisions regarding payment procedures in the City of Baltimore Department of Public Works Specifications (the "Green Book"), including but not limited to the following:

      a. 29 74 Measurement of Quantities
      b. 01 29 75 Scope of Payments
      c. 01 29 76 Progress Payment Procedures
      d. 01 29 77 Payments May Be Withheld
      e. 01 29 78 Application of Monies Retained
      f. 01 29 79 Extra Work Certificates

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

   1. Arrange schedule of values consistent with format of AIA Document G703.
   2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Sustainable design action plans, including preliminary project materials cost data.
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706.
5. AIA Document G706A.
6. AIA Document G707.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally, where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:

   a. Same digital data software program, version, and operating system as original Drawings.

2. File Submittal Format: Submit or post coordination drawing files PDF format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in AutoCAD DWG format version 2024 and REVIT V. 2023.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.6 ADMINISTRATIVE PROCEDURES

A. Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress of the Work. Such activities include; but are not limited to, the following:
1. Preparation of Contractor’s Construction Schedules
2. Preparation of the Schedule of Values
3. Installation and Removal of Temporary Facilities and Controls
4. Delivery and Processing of Submittals
5. Progress Meetings
6. Project Closeout Activities

B. Staff Names: Within 15 days of Notice to Proceed, submit a list of Contractor's staff assignments, including Superintendent and personnel at the site; identify individuals, their duties and responsibilities, addresses and telephone numbers.

1.7 COMMUNICATIONS

A. Project Identification:

1. All correspondence pertaining to this Project shall contain the Project Name and the date written or prepared.
2. All written communication including transmittals, submittals, Requests for Information (RFI), electronic / e-mail correspondence shall identify the Project with the Architect's Project Number in the subject, title or reference line or elsewhere in the text where appropriate. The Project Number can be found on the Drawing Title Block (below the Sheet No.) or in the first line of Specification footer.

1.8 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Owner name.
2. Owner's Project number.
3. Name of Architect.
4. Architect's Project number.
5. Date.
6. Name of Contractor.
7. RFI number, numbered sequentially.
8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature.
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.9 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and/or CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in REVIT V. 2023 and/or AutoCAD V. 2024.
4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

5. The following digital data files will be furnished for each appropriate discipline:

a. Floor plans.
b. Reflected ceiling plans.

1.10 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Before any work is started, responsible representatives for the General Contractor, and subcontractors, including the designated job superintendent for the Project, shall meet at the site with the Architect and the Owner's Representative to review the requirements and conditions under which the Project will be performed.
2. In addition to progress meetings, meetings for review of the materials to be used, procedures to be followed, and an inspection of conditions by the Owner's Representative and the Architect will be required prior to cutting any existing concrete or masonry, lacing any concrete, and applying any paint materials. Coordinate with the Architect to schedule such meetings at least forty-eight (48) hours in advance of the proposed time for the meeting to ensure that both parties will be available or to reschedule if they are not. The Contractor shall, in addition, notify the Architect at least forty-eight (48) hours in advance as to the exact time when such operations will be started.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 1**5** days after execution of the Agreement.

1. Attendees: Owner, Authorized representatives of Owner**,** Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.
h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.

n. Preparation of Record Documents.
o. Work restrictions.
p. Working hours.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.

x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner**,** Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site use.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of Proposal Requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.

18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSPECTION OF CONDITIONS

A. The installer of each component shall inspect the substrate and conditions under which work is performed. Do not proceed until unsatisfactory conditions have been corrected.

B. Verification of Conditions:
1. Verify that existing conditions, surfaces, and substrates are acceptable for subsequent Work.
2. Verify that field measurements, are as required to receive subsequent Work.
3. Verify that existing substrate is capable of structural attachment of new Work being applied or attached.
4. Examine and verify specific conditions described in individual specification sections.
5. Verify that utility services are available, of the correct characteristics, and in the correct location.

C. Report in writing to the Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to Owner.

E. Recheck measurements and dimensions before starting each installation.

3.2 PREPARATION – GENERAL

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply any manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 MANUFACTURER'S INSTRUCTIONS – GENERAL

A. Comply with the manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

B. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

C. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

3.4 INSTALLATION – GENERAL

A. Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

B. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

C. Enclosure of the Work: Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

D. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated or recommended by the manufacturer. Refer questionable mounting height decisions to the Architect for final decision.

3.5 CLEANING AND PROTECTION – GENERAL

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Refer to Section 01 74 00 “Cleaning and Waste Management” for additional requirements.

1. Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure. Such exposures include, but are not necessarily limited to, the following:

1. Excessive Weathering
2. Excessively High or Low Temperatures or Humidity
3. Water or Ice
4. Chemicals or Solvents

5. Heavy Traffic, Soiling, Staining and Corrosion
6. Contact Between Incompatible Materials
7. Theft or Vandalism
8. Excessive Static or Dynamic Loading
9. Thermal Shock
10. Combustion

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.
5. Schedule of Submittals
6. Reports
7. Photographic Documentation
    a. Pre-Construction photographs
    b. Periodic construction photographs.

B. Related Requirements:
1. Section 01 31 00 - Project Management and Coordination.
2. Section 01 33 00 - Submittal Procedures.

C. Comply with the provisions regarding construction progress documentation in the City of Baltimore Department of Public Works Specifications (the "Green Book"), including but not limited to the following:
    a. 01 32 13 Strikes
    b. 01 32 16 Schedules and Reports
    c. 01 32 23 Surveys and Levels
    d. 01 32 27 Daily Construction Log
    e. 01 32 33 Construction Photographs

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.

2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Commissioning Time: Include no fewer than 15 days for commissioning.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for Notice to Proceed.

a. Failure to include any work item required for performance of this Contract must not excuse Contractor from completing all work within applicable completion dates.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Testing and inspection.
i. Commissioning.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates to be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.9 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.

6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction or Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

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SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
3. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.

f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time and GPS location data from camera.

D. File Names: Name media files with date and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.

2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

E. Periodic Construction Photographs: Take 20 photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect may inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 014200 - Quality Requirements
2. Section 017700 - Closeout Procedures
3. Section 017839 - Project Record Documents
4. Subsequent Sections of these Specifications.

C. Comply with the provisions regarding submittal procedures in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 33 10 Manufacturer's List.
2. 01 33 21 Contract Documents, Working Drawings, Shop Drawings, Product Data and

1.3 Samples. DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Product Data: Current published information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves.

D. Samples: Partial sections of manufactured or fabricated components, cuts or containers of materials, full color-range sets, and swatches showing color, texture, and pattern.

E. Shop Drawings: Fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings prepared specifically for the Project.

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architectand additional time for handling and reviewing submittals required by those corrections.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
1. Action Submittals: Submit PDF copies of each submittal unless otherwise indicated..
2. Informational Submittals: Submit PDF copies of each submittal unless otherwise indicated. If retaining second option in "Transmittal for Submittals" Subparagraph below, insert a sample of the form in Project Manual.
3. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810, or form agreed upon with Owner, transmittal form.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1. Use of Architect's Electronic Files: General Contractor and subcontractors may purchase on request for purposes of base plan information only electronic files at a cost of $250.00 per file, contingent upon the signing a CAD File Use Agreement, provided by the Architect or their Consultant. A sample of this document is included at the end of this section as a reference.
    a. Electronic Digital Data CAD Files are available in AutoCAD Version 2024 DWG format and Revit 2023 only.
    b. Architect makes no representations as to the accuracy or completeness of digital data drawing CAD files as they relate to the Contract Drawings.

E. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 15 days for review of each resubmittal.
3. Architect will inform Owner and Contractor is additional review time is required for individual submittals.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit four sets of Samples. Architect will retain three Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least four> sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

    1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.

1. Architect will indicate, via markup on each submittal, the appropriate action, as follows:
   a. Action Stamp: The Architect will stamp each Submittal with a uniform, action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

      1) Where Submittals are marked "CONFORMS AS SUBMITTED", that part of the work covered by the Submittal may proceed, provided it complies with requirements of the Contract Documents. Final payment will depend upon that compliance.
      2) When Submittals are marked "CONFORMS AS NOTED", that part of the work covered by the Submittal may proceed, provided it complies with notations or corrections on the Submittal and requirements of the Contract Documents. Final payment will depend on that compliance.
      3) Returned for Resubmittal: When Submittal is marked "REVISE AND RESUBMIT", do not proceed with that part of the work covered by the Submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new Submittal in accordance with the notations. Resubmit without delay. Repeat, if necessary, to obtain a different action mark.
         a) Do not permit submittals marked "REVISE AND RESUBMIT" to be used at the Project site or elsewhere where work is in progress.
      4) Other Action: Where a Submittal is primarily for information or record purposes, special processing or other activity, the Submittal will be returned marked "ACTION NOT REQUIRED".

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

G. Generally, allow fourteen calendar days for the Architect's review. The Architect will notify the General Contractor if additional review time is required.

1. Allow additional time as requested by the Architect if coordination with other Submittals is required.
2. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related Submittals are received.
3. If an Intermediate Submittal is necessary, process the same as the initial Submittal. Allow seven to ten calendar days for reprocessing each Submittal.
4. The Architect may reject incomplete submittals without reviewing them.
5. The Architect reserves the right to reject a submittal that has clearly not been reviewed first by the General Contractor.
6. No extension of Contract Time will be authorized because of failure to transmit Submittals to the Architect sufficiently in advance of the work to permit processing.

H. If it is determined that a Contractor's failure to make complete and correct submittals results in excessive reviews and delays, the Owner will be entitled to make corrective actions according to the provisions of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

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ELECTRONIC CADD FILE DISCLAIMER, RELEASE AND LIMITATION OF LIABILITY

PRIME AE Group, Inc. ("PRIME AE") agrees to provide _____ ("Recipient") with computer-aided design and drafting files ("Files") on disc or other agreed-to media.

WHEREAS, the Files are described below:

Name of CADD Drawings

WHEREAS, the Files were created by PRIME AE for:

PRIME AE's Project Name: Forest Park Library Addition and Renovation ("Project")

PRIME AE's Project Client: City of Baltimore Department of General Services ("Client")

PRIME AE's Project Manager: Steven Schwartzman, AIA, LEED AP

PRIME AE's Project Number: 22057

NOW, THEREFORE, in consideration of the of PRIME AE providing the Files to the Recipient, Recipient hereby understands and agrees to the following terms and conditions:

1. If PRIME AE's information, word marks, trademarks or logos appear on the Files, it shall be deleted and shall have no force and effect.

2. The electronic Files are provided only as a matter of convenience and PRIME AE cannot be held responsible for the Recipient's possession or subsequent uses of the Files or data contained therewith, including use on any project. Any such use by the Recipient, or others obtaining the Files through the Recipient, will be at the Recipient's sole risk and full legal responsibility. Additionally, if such Files are incomplete at the time of transfer to the Recipient, PRIME AE cannot be responsible for the accuracy, completeness or workability of the documents prepared or delivered by PRIME AE prior to its completion thereof if used, changed, or completed by the Recipient or by another party, including the contractor or the Client. Any use of incomplete work will be at the user's sole risk and without liability or legal exposure to PRIME AE.

3. The Recipient covenants not to sue PRIME AE and shall, to the fullest extent permitted by law, indemnify, defend and hold harmless PRIME AE and the Client and the directors, officers, employees, shareholders and affiliates of either of them ("Indemnitees") from and against any and all claims, suits, actions, liabilities, losses, damages, penalties, judgments, costs and expenses (including attorneys' fees and court costs) which Indemnitees may suffer as the result of Recipient possession or use of Files, or in connection with any third party claim, demand, action or right of action (whether at law or in equity) including, but not limited to any personal injury (including death) or property damage relating to or arising from the Recipients possession or use of the Files. The recipient agrees to promptly pay PRIME AE all sums PRIME AE may be required to pay in settlement of any loss on account thereof, including any claim under the provisions of any Workers' compensation law or similar law.

4. The Files are provided for illustrative purposes. PRIME AE makes no representation as to the compatibility of these Files beyond the above stated software or version of the stated software, or with

the Recipient's hardware and/or software configurations, the ability to convert Files to other formats, or the ability to utilize the Files due to varying hardware configurations. The Recipient agrees to accept the Files in the format provided, no requests for file conversions or modification will be considered.

5. These data Files are not intended to represent precise locations of natural or man-made features, either above or below grade, and are not intended to be record "as-built" model documents. Although the electronic information provided has been produced and made available from sources believed to be reliable, no warranty, expressed or implied, is made regarding the accuracy, adequacy, completeness, reliability or usefulness of any information. Changes may be periodically made to the information herein. It is the user's responsibility to monitor updated information. Because data stored on electronic media can deteriorate undetected or be modified without PRIME AE's knowledge, PRIME AE cannot be held liable for the completeness or correctness of the electronic data once the Recipient takes possession and PRIME AE assumes no obligation to update such Files on future revisions thereof.

6. The Recipient shall treat as confidential all information provided by PRIME AE. PRIME AE is the sole owner of such Files, documents and data provided and is granting a non-exclusive right to Recipient to use such Files. Data or proprietary information received from PRIME AE shall not be published, shared or disclosed for any purpose other than the performance of such services without the prior written authorization of PRIME AE.

7. Recipient waives any and all claims for damages against PRIME AE which may result from any possession or use of the Files. The Recipient agrees to the forgoing terms and conditions, and this Electronic Cad File Disclaimer, Release and Limitation of Liability represents the entire agreement between the parties and supersedes all prior communication either written or oral. This Electronic Cad File Disclaimer, Release and Limitation of Liability shall be interpreted by the laws of the State of Maryland without regard to the choice of law provision. Recipient irrevocably consents to jurisdiction of (and waives dispute of venue in) the State of Maryland.

THE RECIPIENT ACKNOWLEDGES that there has been an opportunity to negotiate the terms and conditions of this Agreement and agrees to be bound accordingly.

RECIPIENT

_____
Signature

_____
Printed Name

_____
Printed Title

_____
Date of Signature

SECTION 013591 – SAFETY, HEALTH, AND ENVIRONMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Owner's administrative requirements for safety and health procedures for the Project.

B. Related Requirements:

1. Section 011100 "Summary"
2. Section 013100 "Project Management and Coordination"
3. Section 013525 "Lead Paint Exposure Protocol."
4. Section 015000 "Temporary Facilities and Controls"
5. Section 024119 "Selective Demolition"

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the "Green Book"), including but not limited to the following:

1. 01 35 24 Accidents
2. 01 35 43 Environmental Protection Procedures

1.3 REFERENCES

A. An addition to publications referenced in the Construction Contract Clauses, the following Code of Federal Regulations (CFR) and other publications designate and define hazardous materials and conditions and establish procedures for handling these materials and conditions. Omission of any publication in this section does not remove any obligation or legal requirement on the part of the contractor to comply with all legal requirements for the location of the work.

1. 29 CFR, Part 1910: Occupational Safety and Health Administration (OSHA) General Industry and Health Standards
2. 29 CFR, Part 1926: OSHA Construction Industry Standards.
3. 40 CFR, Part 61: National Emission Standards for Hazardous Air Pollutants.
4. 40 CFR, Part 261: Environmental Protection Agency (EPA) Characteristics of Hazardous Waste.
5. 40 CFR, Part 761: EPA Polychlorinated Biphenyls (PCBs), Manufacturing, Processing, Distribution in Commerce and Use Prohibitions
6. 40 CFR, Part 763: EPA Asbestos.
7. Federal Standards 313A: Safety Data Sheets, Preparation and the Submission of.

8. NIH DCAB publication “Standards for Temporary Construction,” March 1988.

B. Acquisition of Publications: Referenced CFR publications may be purchased from the

1. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

1.4 SUBMITTALS

A. Contractor’s Safety and Health Program: The Contractor shall submit a written copy of the Company Safety and Health Program as well as the site specific safety and health plan for the project to the Owner within 14 calendar days of the Notice to Proceed or before work commences on the project site, whichever is earlier.

B. Accident Reports: The Contractor must submit to the Owner a written report within three calendar days of any accident, fire, emergency, theft or incident in which any personal or property damage took place, regardless of any other notifications performed. Include a copy of each accident report that is submitted by the Contractor or Subcontractors to their insurance carriers, within seven calendar days after the date of the accident.

C. Safety Data Sheets (SDS): The contractor shall provide the Safety Data Sheets (SDS’s) for all products containing hazardous chemicals to the Owner within 14 calendar days of the Notice to Proceed or before work commences on the site. The MSDS’s shall be maintained at the project site for workers and the Owner. MSDS’s for new products shall similarly be submitted to the Owner and be retained at the project site until completion of the project.

1.5 PRECONSTRUCTION SAFETY MEETING

A. Prior to commencing construction, representatives of the Contractor, including the general superintendent and one or more safety representatives, shall meet with the Owner for the purpose of reviewing Contract safety and health requirements.
1. The Contractor’s Safety and Health Program and Site Specific Safety and Health Plan shall be reviewed, and implementation of safety and health provisions pertinent to the Work shall be discussed.
2. The Contractor shall be prepared to discuss, in detail, the Contractor’s Site Specific Safety and Health Plan including measures intended to control any unsafe or unhealthy conditions associated with the work to be performed under the contract.
3. This meeting may be held in conjunction with the preconstruction conference, if so directed by the Owner. The conduct of this meeting is not contingent upon a general preconstruction meeting.
4. The level of detail for the safety meeting is dependent upon the nature of the work and the potential inherent hazards.

1.6 COMPLIANCE WITH REGULATIONS

A. The work, including contact with or handling of hazardous materials, disturbance or dismantling of surfaces containing hazardous materials, and disposal of hazardous materials, shall comply

with the applicable requirements of 29 CFR Parts 1910 and 1926, and 40 CFR Parts 61, 261, 761 and 763.

B. Work involving disturbance or dismantling of asbestos or asbestos containing materials, demolition of structures containing asbestos and removal of asbestos, shall comply with 40 CFR Part 61, Subparts A and M, and 40 CFR Part 763.

C. Work shall additionally comply with all applicable state and local safety and health regulations.

D. In case of a conflict between applicable regulations, the more stringent requirements shall apply.

E. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable codes, standards and regulations pertaining to the health and safety of personnel during execution of the Work, and shall hold the Owner harmless for any action on the Contractor's part, or that of the Contractor's employees or subcontractors, that result in illness, injury or death.

1. The Contractor shall have written safety and health programs in compliance with 29 CFR Parts 1910 and 1926.
2. Inspections, Tests, and Reports: The required inspections, tests and reports made by the Contractor, subcontractors, specially trained technicians, equipment manufacturers, and others as required, shall be at the Contractor's expense.

1.7 USE OF POWER ACTUATED FASTENER TOOLS

A. Use of explosives shall be prohibited.

B. Power actuated fastener tools are often used on construction sites due to the unique manner in which objects can be accurately and positively secured to a substrate. Also, these tools tend to allow for work to proceed more rapidly and efficiently with desirable results. However, these
1. tools also present potential problems to the work area relative to damaged base material and fasteners. Also, the fastener tools present health and safety hazards to untrained users of fastener equipment, unprotected workers in the immediate work area, as well as building occupants that might be present. Based upon these circumstances, there is a need for safe work practice requirements to be followed whenever such equipment is used. It should be noted that fasteners can be powered or driven primarily by powder charges, gas, or pneumatic means.

C. Power actuated fastener tools (ex. nail guns, etc.) including pneumatic, powder actuated, and gas actuated tools shall not be used or brought to the project site without the permission of the Owner. Any permission request will include documentation of appropriate training, on-site demonstration, and written standard operating procedures and safety plan for the use of this equipment in the particular application requested.

D. The Contractor must comply with the following in order for the Owner to grant permission to use the power actuated fastener equipment. The Contractor will be fully responsible to every effort to appropriate protect the safety of people and equipment when utilizing this tool. These include, but are not limited to, the following:

1. The Contractor shall inspect the substrate and the fastening material to determine if this proposed fastening method is appropriate. This determination should include a description of the type of material to be fastened and the method of fastening. The base material should be inspected to determine whether it is too hard, soft, or brittle that it may cause spalling, cause the fastener to shatter or not hold, or cause the fastener to free flight.
2. Contractor shall develop a written description of the work to be performed for the specific project for which permission has been requested. The contractor shall develop written instructions or procedures on the use of the fastener tool. The standard operating procedures should include the type of surfaces (i.e., metal studs to floor, hangers to the deck, etc.) to be fastened to minimize damage to the building and injury to the user, other employees, and the public and safety precautions. These documents need to be submitted for approval to the Owner prior to being accepted for use.

   NOTE: Concrete or other surfaces that are damaged shall not be fastened. When fastening into concrete, do not fasten closer than two inches from the edge.
3. Trained, competent, and credentialed individuals shall be the only persons allowed to utilize such fastener tools.
4. Individuals will be expected to demonstrate their competency with the Owner approved fastener equipment prior to being authorized usage on the specific project. This demonstration should be performed in the presence of the Owner.
5. A "Competent Person" shall be present to ensure that the fastener tool is being used properly and workers not involved with the fastener task are clear of the immediate work area. This would include non-construction workers or building occupants above and below where the fastener tool is being used.
6. Fastener tool operators shall report immediately any problems associated with the device or fastener work to the "Competent Person" or immediate supervisor and not proceed until the problem has been resolved and authorization given to proceed.
7. Only the Owner-approved fastener tool shall be used for the specific requested fastening Application.
8. The Contractor shall provide information about the fastener tool(s) to be used on the job. This should include the name of the manufacturer and model number. No other fastener tool can be used without the permission of the Owner.
9. The fastener tool shall be operated at the lowest power or charge setting, as well as using the shortest fasteners to ensure a sufficient fastening, as well as to minimize personal injury and/or property damage.
10. The fastener equipment should be inspected for proper operation before use to ensure the proper discharge and a solid fastener attachment.
11. The fastener equipment should be unloaded before inspecting, servicing, cleaning or storing.
12. The fastener equipment and charging equipment shall be stored in a tamper resistant container that can be locked when not in use.
13. The fastener equipment shall be used in accordance with the owner's manual and manufacturer's directions.
14. The appropriate personal protective equipment (i.e., safety glasses, hard hats, hearing protection, etc.) shall be worn by the operator of the fastener equipment.

1.8 WORK UNDERGROUND OR IN CONFINED SPACES

A. Work shall comply with appropriate OSHA regulations; including but not limited to, 29 CFR1910.146

B. The Contractor shall remove water and debris and properly vent manholes before commencement and during execution of work in manholes.

C. The Contractor shall have a competent person on site during the project as per the OSHA construction standard.

1.9 ELECTRICAL

A. Electrical arc welding equipment shall not be connected to the building power supply.

1.10 MATERIAL DELIVERIES

A. Whenever practicable, deliveries shall be made during regular working hours and only when the Contractor's representative is available to receive them.
   1. Deliver material in approved containers and with properly licensed vehicles and operators.
   2. Open delivery vehicles are not permitted. Deliver materials in fully closed vehicles or tarp-covered vehicles.
   3. All dump trucks shall be fully covered while in transport to and from the unloading site. All loads shall be securely fastened until unloading.
   4. Engines shall not be left running while vehicles are loading, unloading, waiting or parked.
   5. Do not block roads, walks, building entrances/exits, fire hydrants and standpipes, exterior tanks or building gas connections.
   6. Exercise caution regarding all pedestrians and when backing the vehicle.

1.11 HAZARDOUS MATERIAL

A. The Contractor shall bring to the attention of the Architect/Engineer (A/E) and the Owner, any material encountered during execution of the Work that the Contractor suspects is hazardous. Work shall be stopped as it relates only to the questioned hazardous material so that the Owner can recommend testing to an accredited third party laboratory, to determine if the material is hazardous before work can be authorized to proceed.

B. If the tested material is found to be hazardous, and/or if additional protective measures are required, a change to the Contract price may be provided, subject to the applicable provisions of the Contract.

1.12 ADDITIONAL SAFETY REQUIREMENTS

A. No work shall be performed in any area occupied by the public unless approved by the Owner.

1. Accident Treatment and Records: The Contractor shall post emergency first aid information.
2. No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official lockout/ tagout tag attached to it, nor shall such tag be removed except as provided in this section.
3. When work is to be performed on electrical circuits, the work shall be performed only by qualified personnel following the required safety procedures.
4. Identification markings on building light and power distribution circuit breakers shall not be relied on for establishing safe work conditions.
5. Before clearance will be given on any equipment other than electrical (generally referred to as mechanical apparatus), the apparatus, valves, or systems shall be secured in a passive condition with the appropriate vents, pins, and locks.
6. Pressurized or vacuum systems shall be vented to relieve differential pressure completely.
7. Vent valves shall be lockout/tagout tagged open during the course of the work.
8. Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, systems or areas shall be purged, ventilated, or otherwise made safe prior to entry.
9. Hot Work: If any welding, cutting, or spark generating activity is to be performed, the contractor shall comply with all aspects of OSHA Standard Subpart Q Welding, Cutting and Brazing 29 CFR 1910.252 relating to fire prevention associated with hot work.
10. If a roof replacement is to be performed, consideration should be given for the location of the kettles (if any) for the new asphalt roof materials, so as to minimize the potential air contamination problem in adjacent occupied buildings.
11. Crane Safety
    a. Safety watches shall be used to assess any safety concerns within the swing path of the crane during both the removal /lowering of equipment and also during the lifting /installation of new equipment. A dedicated, full-time safety watch shall be used anytime the crane is in use.
    b. b. Particular attention is needed to ensure that spectators and/or other pedestrians are kept clear of the construction site while the crane is in use. Allowable locations for siting the crane are shown on the drawings.
    c. Daily inspections are required of crane and associated components.
    d. Comply with all OSHA requirements related to crane operation.

1.13 PERSONNEL PROTECTIVE EQUIPMENT

a. A. Special facilities, devices, equipment and similar items used by the Contractor in execution of the work shall comply with 29 CFR, Part 1910, Subpart I and other applicable regulations.

PART 2 - PRODUCTS

2.1 SAFETY AND HEALTH PROGRAMS:

A. The Contractor shall submit copies of the written site specific project safety and health plan and emergency action procedures, as applicable to the work scope, as required as a result of the safety meeting, or as required by OSHA 29 CFR, Part 1926 including but not necessarily limited to the procedures and programs that support the requirements of the following:
   1. Designation of Safety Competent Person

2. Occupational Noise Exposure
3. Fall Protection
4. Personnel Protective Equipment
5. Control of Hazardous Energy
6. Hazardous Materials Waste Management Plan (draft if final plan has not been accepted)
7. Electrical Safety Related Work Practices
8. Lead
9. Asbestos
10. Refrigerants
11. Respirator Protection
12. Confined spaces
13. Emergency evacuation and reporting
14. Hot Work

B. Crystalline Silica Rule

2.2 CONTRACTOR'S SAFETY AND HEALTH PLAN:

A. In addition to specific safety and health programs applicable to the project, Contractor shall submit to the Owner a copy of the firms' general Safety and Health Plan listing emergency procedures and contact persons with home addresses and telephone numbers.

2.3 PERMITS:

A. If hazardous materials are disposed of off-site, submit copies of shipping manifests and permits from applicable federal, state or local authorities and disposal facilities, and submit certificates that the material has been disposed of in accordance with regulations.

2.4 LOCKOUT/TAGOUT EQUIPMENT

A. Appropriate lockout/tagout equipment will be provided by the contractor. When required contractor will provide device to allow multiple locks.

PART 3 - EXECUTION

3.1 EMERGENCY SUSPENSION OF WORK

A. When the Contractor is notified by the A/E or the Owner, of non- compliance with the safety or health provisions of the Contract, the Contractor shall immediately, unless otherwise instructed, correct the unsafe or unhealthy condition.

1. If the Contractor fails to comply promptly, all or part of the work will be stopped by notice form the A/E.
2. When, in the opinion of and by notice given by the A/E and or the Owner, satisfactory corrective action has been taken by the Contractor, work shall resume.

3. The Contractor shall not be allowed any extension of time or compensation for damages in connection with a work stoppage for an unsafe or unhealthy condition.

3.2 PROTECTION OF PERSONNEL

A. The Contractor shall take all necessary precautions to prevent injury to the public, occupants, or damage to property of others. The public and occupants includes all persons not employed by the Contractor or a subcontractor.

B. Wherever practical, the work area shall be fenced, barricaded or otherwise blocked off from the public or occupants to prevent unauthorized entry into the work area.

1. Provide traffic barricades and traffic control signage where construction activities occur in vehicular areas.

2. Corridors, aisles, stairways, doors and exit ways shall not be obstructed or used in a manner to encroach upon routes of ingress or egress utilized by the public or occupants, or to present an unsafe or unhealthy condition to the public or occupants.

3. Store, position and use equipment, tools, materials, scraps and trash in a manner that does not present a hazard to the public or occupants by accidental shifting, ignition or other hazardous activity.

4. Store and transport refuse and debris in a manner to prevent unsafe and unhealthy conditions for the public and occupants. Cover refuse containers, and remove refuse on a frequent regular basis acceptable to the Owner. Use tarpaulins or other means to prevent loose transported materials from dropping from trucks.

C. Construction Dust: Provide measures to prevent the discharge of airborne dust to adjacent properties. Dust potentially will be generated by activities such as site preparation, excavation, trenching, saw cutting or drilling of brick, concrete, or stone, as well as road surface dust from vehicles. Use water spray, temporary enclosures, vacuum collection, sweeping and any other methods necessary to minimize or eliminate dust and dirt migration. Comply with governing environmental protection requirements and the requirements of the Owner (i.e., no visible dust shall be seen leaving the site). If the level of dust or dirt produced is unacceptable to the Owner all work will be stopped until the situation is corrected. Refer to specification section “Temporary Controls”.

D. Alternate Precautions: When the nature of the work prevents isolation of the work area and the public or building occupants may be in or pass through, under or over the work area, alternate precautions such as the posting of signs, the use of signal persons, the erection of barricades or similar protection around particularly hazardous operations shall be used as appropriate.

E. Public Thoroughfare: When work is to be performed over a public thoroughfare such as a sidewalk, roadway or other site access way, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screens or barricades. When the exposure to heavy falling objects exists, as during the erection of building walls or during demolition, special protection of the type detailed in 29 CFR, Parts 1910 and 1926 shall be provided.

3.3 ENVIRONMENTAL PROTECTION

A. General Requirements
   1. Dispose of solid, liquid and gaseous contaminants in accordance with local codes, laws, ordinances and regulations.
   2. Comply with applicable federal, state and local noise control laws, ordinances and regulations, including but not limited to 29 CFR, Part 1910.95 and 29 CFR, Part 1926.52.

B. Specific Requirements

   1. On any project where fluorescent light bulbs are removed, unless the fluorescent light bulbs are going to be re-used, these items need to be carefully removed and stored for proper disposal as “Universal Waste” as required by the EPA. This would include all other types of light bulbs such as incandescent, sodium, mercury, etc., as well as contained liquid mercury components retrieved from thermostats and thermometers. These materials cannot be disposed as demolition waste.
   2. If any transformers are to be disposed the presence or absence of PCBs shall be verified, by testing if necessary.
   3. During removal or renovation of any system containing chemicals, gases or refrigerants, the appropriate equipment shall be used to capture these substances and prevent their release to the atmosphere. This equipment must be certified as required and be used by properly trained and certified technicians as required by applicable federal, state and local laws and regulations. Proper recordkeeping procedures shall be followed.
   4. Containers of volatile sealers, paints, solvents, roofing coatings and other materials should be covered when not in use to prevent the release of volatile organic compounds into the atmosphere. This requirement also applies to the disposal of such products.

END OF SECTION 013591

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SECTION 013591 - HISTORIC TREATMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and treatment procedures for designated historic spaces, areas, rooms, and surfaces in Project. Existing building is not listed on any historic registers but for this project the building shall be treated as if it is listed.

1.3 DEFINITIONS

A. Consolidate: To strengthen loose or deteriorated materials in place.

B. Design Reference Sample: A sample that represents Architect's prebid selection of work to be matched; it may be existing work or work specially produced for Project.

C. Dismantle: To disassemble or detach a historic item from a surface, or a nonhistoric item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

D. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance that are important to the successful restoration and reconstruction] as determined by Architect.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.

H. Remove: To take down or detach a item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

I. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

J. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

K. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

L. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

M. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.

N. Retain: To keep an element or detail secure and intact.

O. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.

P. Salvage: To protect removed or dismantled items and deliver them to Owner ready for reuse.

Q. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.

R. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.5 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: An experienced firm regularly engaged in historic treatments similar in nature, materials, design, and extent to the work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in historic treatment work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on site when historic treatment work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond control of the specialist firm.

B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

C. Safety and Health Standard: ANSI/ASSP A10.6.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from historic treatment procedures.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
3. Protect floors and other surfaces along hauling routes from damage, wear, and staining.

B. Temporary Protection of Historic Materials:

1. Protect existing historic materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Architect.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

3.2 PROTECTION FROM FIRE

A. Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

a. If combustible material cannot be removed, provide fire blankets to cover such materials.

3. Prohibit smoking by all persons within Project work and staging areas.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.

2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for type of fire risk in each work area. Ensure that nearby personnel and fire-watch personnel are trained in fire-extinguisher and blanket use.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in historic treatment program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL HISTORIC TREATMENT

A. Have historic treatment work performed only by qualified historic treatment specialists.

B. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 013233 "Photographic Documentation."

D. Perform regular inspections of Project site as the Work progresses to detect hazards resulting from historic treatment procedures.

E. Follow the procedures in subparagraphs below and procedures approved in historic treatment program unless otherwise indicated:

1. Retain as much existing material as possible; repair and consolidate rather than replace.
2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
3. Use reversible processes wherever possible.
4. Use historically accurate repair and replacement materials and techniques unless otherwise indicated.
5. Record existing work before each procedure (preconstruction) and progress during the work with digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 013233 "Photographic Documentation."

F. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

G. Where work requires existing features to be removed or dismantled and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.

H. Identify new and replacement materials and features with permanent marks hidden in the completed Work to distinguish them from original materials. Record a legend of identification marks and the locations of the items on record Drawings.

END OF SECTION 013591

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Section includes quality requirements for the Project, including but not limited to the following:
   1. Reference Standards.
   2. Definitions.
   3. Submittals.
   4. Quality Assurance.
   5. Quality Control Procedures.

C. Related Requirements:

   1. Section 014100 "Regulatory Requirements.

D. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.

E. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the "Green Book"), including but not limited to the following:

   1. 01 45 01 Inspection of Materials and Work
   2. 01 45 14 Quality of Material
   3. 01 45 14.01 Equipment and Devices
   4. 01 45 15 Access to Work
   5. 01 45 16.01 Defective Materials and Work
   6. 01 45 16.13 Failure to Remove and Renew Defective Materials and Work
   7. 01 45 17 Authority and Duties of Engineers and Inspectors
   8. 01 45 24.01 Field Laboratory
   9. 01 45 24.02 Responsibility of Contractor for Plant and Methods
   10. 01 45 25 Test of Materials
   11. 01 45 30 Testing Standards
   12. 01 45 34 Use of Explosives

1.3 REFERENCE STANDARDS

A. Comply with requirements of standards referenced in each Section, except when more stringent requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where another date is established by code.

C. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of ` previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.
b. Demonstrate aesthetic effects.
c. Demonstrate the qualities of products and workmanship.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by

a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.5 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.7 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.8 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Statement on condition of substrates and their acceptability for installation of product.
2. Statement that products at Project site comply with requirements.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Statement that equipment complies with requirements.
2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
1. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
2. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
5. Do not perform duties of Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and

provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Refer to Section 016000 Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.

1. 016000 “Product Requirements.”

2.2 FABRICATION

A. Coordinate fabrication schedule with construction progress as directed by the Contractor to assure proper sequence and scheduling of work.

B. Perform field measuring prior to fabrication to ensure proper fit.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Engage installers who are skilled in the types of tasks required for executing the Work.

B. Engage manufacturer’s field representatives when necessary for achieving optimum work results.

3.2 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.3 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

B. Submit report in duplicate within 15 days of observation to A/E and Owner’s Representative for information.

C. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to A/E and Owner’s Representative.
4. Identification of testing agency or special inspector conducting test or inspection.
5. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for the A/E and the Owner Representative’s reference during normal working hours.

3.4 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.

24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; [American Society of Mechanical Engineers (The)]; www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
47. CARB - California Air Resources Board; www.arb.ca.gov.
48. CDA - Copper Development Association Inc.; www.copper.org.
49. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.compositepanel.org.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - CSA Group; www.csagroup.org.
63. CSI - Cast Stone Institute; www.caststone.org.
64. CSI - Construction Specifications Institute (The); www.csiresources.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTA - Consumer Technology Association; www.cta.tech.

67. CTI - Cooling Technology Institute; www.coolingtechnology.org.
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECIA - Electronic Components Industry Association; www.ecianow.org.
72. EIMA - EIFS Industry Members Association; www.eima.com.
73. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
74. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
75. ESTA - Entertainment Services and Technology Association; www.esta.org.
76. EVO - Efficiency Valuation Organization; www.evo-world.org.
77. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
78. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
79. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
80. FM Global - FM Global; www.fmglobal.com.
81. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
82. FSA - Fluid Sealing Association; www.fluidsealing.com.
83. FSC - Forest Stewardship Council U.S.; www.fscus.org.
84. GA - Gypsum Association; www.gypsum.org.
85. GS - Green Seal; www.greenseal.org.
86. HI - Hydraulic Institute; www.pumps.org.
87. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
88. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
89. IAS - International Accreditation Service; www.iasonline.org.
90. ICC - International Code Council; www.iccsafe.org.
91. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
92. ICPA - International Cast Polymer Association (The); www.theicpa.com.
93. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
94. IEC - International Electrotechnical Commission; www.iec.ch.
95. IEEE SA - IEEE Standards Association; https://standards.ieee.org.
96. IES - Illuminating Engineering Society; www.ies.org.
97. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
98. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
99. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
100. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
101. Intertek - Intertek Group; www.intertek.com.
102. ISA - International Society of Automation (The); www.isa.org.
103. ISFA - International Surface Fabricators Association; www.isfanow.org.
104. ISO - International Organization for Standardization; www.iso.org.
105. ITU - International Telecommunication Union; www.itu.int.
106. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
107. LPI - Lightning Protection Institute; www.lightning.org.
108. MCA - Metal Construction Association; www.metalconstruction.org.
109. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
110. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
111. MHI - Material Handling Industry; www.mhi.org.
112. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
113. MPI - Master Painters Institute; www.paintinfo.com.

114. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
115. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
116. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
117. NADCA - National Air Duct Cleaners Association; www.nadca.com.
118. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
119. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
120. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
121. NBI - New Buildings Institute; www.newbuildings.org.
122. NCMA - National Concrete Masonry Association; www.ncma.org.
123. NEBB - National Environmental Balancing Bureau; www.nebb.org.
124. NECA - National Electrical Contractors Association; www.necanet.org.
125. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
126. NEMA - National Electrical Manufacturers Association; www.nema.org.
127. NETA - InterNational Electrical Testing Association; www.netaworld.org.
128. NFHS - National Federation of State High School Associations; www.nfhs.org.
129. NFPA - National Fire Protection Association; www.nfpa.org.
130. NFPA - NFPA International; (see NFPA).
131. NFRC - National Fenestration Rating Council; www.nfrc.org.
132. NGA - National Glass Association (The); www.glass.org.
133. NHLA - National Hardwood Lumber Association; www.nhla.com.
134. NLGA - National Lumber Grades Authority; www.nlga.org.
135. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
136. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
137. NRCA - National Roofing Contractors Association; www.nrca.net.
138. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
139. NSF - NSF International; www.nsf.org.
140. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
141. NSPE - National Society of Professional Engineers; www.nspe.org.
142. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
143. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
144. NWFA - National Wood Flooring Association; www.nwfa.org.
145. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
146. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
147. PDI - Plumbing & Drainage Institute; www.pdionline.org.
148. PLASA - PLASA; www.plasa.org.
149. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
150. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
151. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
152. RFCI - Resilient Floor Covering Institute; www.rfci.com.
153. RIS - Redwood Inspection Service; (see WWPA).
154. SAE - SAE International; www.sae.org.
155. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
156. SDI - Steel Deck Institute; www.sdi.org.
157. SDI - Steel Door Institute; www.steeldoor.org.
158. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.

159. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
160. SIA - Security Industry Association; www.securityindustry.org.
161. SJI - Steel Joist Institute; www.steeljoist.org.
162. SMA - Screen Manufacturers Association; www.smainfo.org.
163. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
164. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
165. SPIB - Southern Pine Inspection Bureau; www.spib.org.
166. SPRI - Single Ply Roofing Industry; www.spri.org.
167. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
168. SSINA - Specialty Steel Industry of North America; www.ssina.com.
169. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
170. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
171. SWI - Steel Window Institute; www.steelwindows.com.
172. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
173. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
174. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
175. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
176. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
177. TMS - The Masonry Society; www.masonrysociety.org.
178. TPI - Truss Plate Institute; www.tpinst.org.
179. TPI - Turfgrass Producers International; www.turfgrasssod.org.
180. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
181. ULSE - UL Standards & Engagement Inc.; www.ulse.org.
182. UL - UL Solutions Inc.; www.ul.com.
183. USGBC - U.S. Green Building Council; www.usgbc.org.
184. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
185. WA - Wallcoverings Association; www.wallcoverings.org.
186. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
187. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
188. WDMA - Window & Door Manufacturers Association; www.wdma.com.
189. WI - Woodwork Institute; www.woodworkinstitute.com.
190. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
191. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.

5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from U.S. General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specifications and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).

2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014339 - MOCKUPS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Integrated exterior mockups.

1.3 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
3. Review testing procedures to be performed on mockups.
4. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.5 ACTION SUBMITTALS

A. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Build mockups to do the following:

1. Verify selections made under Sample submittals.
2. Demonstrate aesthetic effects.
3. Demonstrate the qualities of products and workmanship.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Notifications:

1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Allow seven days for initial review and each re-review of each mockup.

D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.

1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

A. Construct integrated exterior mockup. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

E. The Work of integrated exterior mockups includes, but is not limited to, the following:

1. Masonry veneer.
    a. Masonry cleaning.
    b. Masonry repair.
    c. Masonry repointing.
    d. New masonry installation.
    e. Infill opening using existing masonry.

F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 013233 "Photographic Documentation." Provide photographs showing details of interface of different materials and assemblies.

G. Retain approved mockups constructed in place. Incorporate fully into the Work.

END OF SECTION 014339

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 013523 “Safety, Health, and Environment”
3. Section 017700 “Closeout Procedures”

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 51 00 Temporary Utilities
   a. 01 51 13 Temporary Electrical Services
   b. 01 51 23 Temporary Heat
   c. 01 51 33 Temporary Telecommunications
   d. 01 51 36 Temporary Water
   e. 01 51 37 Temporary Sanitary Facilities
   f. 01 52 00 Construction Facilities
   g. 01 52 19 Sanitary Provisions
2. 01 55 00 Vehicular Access and Parking
   a. 01 55 26 Maintenance of Traffic
   b. 01 55 26.01 Public Convenience and Safety
   c. 01 55 26.02 Flagger
   d. 01 55 27 Barricades, Danger, Warning, and Detour Signs
   e. 01 55 28 Detours
3. 01 58 00 Project Identification

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its

use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Provide, pay for, and maintain temporary facilities as needed for proper administration of the Project, including but not limited to:

1. Field office.
2. Storage and protection of materials and equipment.
3. Storage and protection of samples.
4. Temporary toilets, wash facilities and drinking water.
5. Covered waste containers.
6. First Aid Supplies: Comply with governing regulations.
7. Fire Extinguishers: Comply with NFPA 10 and 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
8. Construction waste management facilities.
9. Staging area protection. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect**,** and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment for each field office.

I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
   a. Adobe Reader DC.
   b. WinZip 10.0 or higher.
1. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.
2. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and non tracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary offsite parking areas for construction personnel.

E. Storage and Staging: Use designated areas of Project site for storage and staging needs.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
3. Maintain and touch up signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Temporary Elevator Use: Use of elevators is not permitted.

I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

H. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 66 00 Product Storage and Handling Requirements
   a. 01 66 10 Storage of Materials

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

2. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017123 - FIELD ENGINEERING

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. Work included: Provided at the Contractor's expense, such field engineering services are required for proper completion of the Work including, but not necessarily limited to:

1. The Contractor shall have property lines located and marked and corners set by a certified land surveyor. Permanent corner markers shall be installed where they do not already exist.

2. The Contractor shall be responsible for all stakeouts and elevation checks required for construction. All such Work shall be performed by a professional land surveyor. The surveyor shall verify adequacy of benchmarks before starting construction.

3. Before the start of any building construction, the Contractor shall have a professional land surveyor locate and stake building corners, driveway entrances, driveways, parking areas and walls. If there are any discrepancies between the actual layout and the project site plan, they shall be brought to the attention of the Architect and resolved before Work proceeds. A building and site stake out drawing stamped and signed by a professional land surveyor may be submitted in lieu of this preliminary stake out.

4. After the corners of the exterior walls have been started, the Contractor shall obtain a wall check survey certificate made by a professional land surveyor. This survey shall show the accurate location of the building with reference to property lines.

5. After the first sections of slab-on-grade have been placed in the building, the Contractor shall have a professional land surveyor verify and record the finish floor elevation on the wall check survey.

6. At the end of the project, the Contractor shall have a professional land surveyor prepare an as-built survey showing the accurate horizontal and vertical locations of all building corners, paved areas, sidewalks, utilities, fencing, site walls stormwater management facilities in accordance with the requirements of Baltimore City, etc. located within the project area.

1.3 RELATED WORK

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

B. Additional requirements for field engineering also may be described in other Sections of these Specifications.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 SUBMITTALS

A. Comply with pertinent provisions of Section 01300-Submittals.

B. Upon request of the Architect, submit;

1. Data demonstrating qualifications of persons proposed to be engaged for field Engineering services.

2. Documentation verifying accuracy of field engineering work.

3. Certifications, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance with requirements of the Contract Documents.

1.6 PROCEDURES

A. In addition to procedures directed by the Contractor for the proper performance of the Contractor's responsibilities:

1. Locate and protect control points before starting Work on the site.

2. Preserve permanent reference points during process of the Work.

3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.

4. Promptly advise the Architect when a reference point is lost or destroyed, or requires relations because of other changes in the Work.

a. Upon direction of the Architect, require the field engineer to replace reference stakes or markers.

b. Locate such replacements according to the original survey control.

END OF SECTION 017123

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
2. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 71 00 Examination and Preparation
2. 01 71 13 Mobilization
3. 01 71 25 Test Pits
4. 01 71 33 Adjacent Buildings and Property
5. 01 73 00 Execution
6. 01 73 26 Salvageable Materials
7. 01 74 00 Cleaning and Waste Management
8. 01 74 13 Progress Cleaning
9. 01 74 16 Maintaining Flow of Sewers and Drains
10. 01 74 16.01 Bypass Pumping for Wastewater Facilities Undergoing Construction
11. 01 74 20 Excavated Material to be Disinfected
12. 01 75 00 Starting and Adjusting

13. 01 76 00 Protecting Installed Construction
14. 01 76 01 Preservation and Restoration of Property, Trees, Monuments, Streams, Lakes, and Reservoirs
15. 01 76 02 Contractor's Responsibility for Work
16. 01 76 03 Flood and Storms
17. 01 76 04 Utilities
18. 01 76 05 Removal of Obstructions
19. 01 76 06 Protection, Shifting, or Removal of Structures by Owners of Same
20. 01 76 07 Obstructions

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION REQUIREMENTS

A. Pre-Installation Meetings: Conduct pre-installation meetings according to Division 01 requirements for Project Management and Coordination, and as follows:
   1. Pre-installation meetings shall be conducted with all trades whose work requires coordination with other trades and also when specified.
   2. Pre-installation meetings shall be scheduled and conducted sufficiently in advance of the work to allow evaluation and correction of existing conditions that would adversely affect the quality of the work as a whole.

B. Mockups: Construct mock-ups according to requirements specified in subsequent Sections. Convene meetings to review mock-ups for compliance with requirements. Coordinate with the Construction Progress Schedule to ensure timely reviews, responses, and resolutions prior to commencing the work.

1.5 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where

indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

1.6 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation.

1. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
2. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is affected by damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures".

1.7 INFORMATIONAL SUBMITTALS

A. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

B. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

1.8 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.9 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and

electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
2. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

B. If including refrigerant recovery in this Section, retain first "Refrigerant Recovery Technician Qualifications" Paragraph below and delete second paragraph. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.

C. Refrigerant Recovery Technician Qualifications: Comply with requirements in Section 024119 "Selective Demolition."

D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials, including the following:

1. Meet IGCC requirements for 501.2.8 Building Site Waste Management.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in Section 024119 "Selective Demolition for salvaging demolition waste.

B. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items for Not permitted on Project site.

D. Salvaged Items for Owner's Use:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch size or as required by recycling receiver.

B. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum as required by recycling receiver.
2. Clean and stack undamaged, whole masonry units or useable partial pieces on pallets for reuse where documented in construction documents.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

H. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

J. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

K. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

L. Conduit: Reduce conduit to straight lengths and store by material and size.

M. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 77 00 Closeout Procedures
   a. 01 77 16 Final Inspection
   b. 01 77 17 Final Acceptance
   c. 01 77 20 Last Payment to Terminate Liability of the City
   d. 01 77 21 Evidence of Payment for Labor and Materials

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificate of Insurance: For continuing coverage.

B. Field Report: For pest-control inspection.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements.
9. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.7 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.

d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:

a. PDF Electronic File: Architect**,** will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
d. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
e. Vacuum and mop concrete.
f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
h. Remove labels that are not permanent.
i. Wipe surfaces of mechanical and electrical equipment**,** elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
n. Clean strainers.
o. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Special operating and maintenance data requirements for specific equipment or building operating systems are included in the appropriate Specifications Sections of Divisions 02 through 33.
2. Section 013300 "Submittal Procedures".
3. Section 017700 "Closeout Procedures".
4. Section 017839 "Project Record Documents".

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

1. Include procedures to follow and required notifications for warranty claims.

G. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.9 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Section 013300 “Submittal Procedures.”
3. Section 017700 “Closeout Procedures.”

C. Comply with the provisions related to this Section in the City of Baltimore Department of Public Works Specifications (the “Green Book”), including but not limited to the following:

1. 01 78 23 Operation and Maintenance Data
2. 01 78 24 Manufacturer's Certificates
3. 01 78 36 Warranties
4. 01 78 39 Project Records Documents

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one set of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders**,** Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.

g. Warranties and bonds.
h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings on CD-ROM or thumb drive.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

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SECTION 018113.33 - SUSTAINABLE DESIGN REQUIREMENTS - IgCC/ASHRAE 189.1

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with certain International Green Construction Code powered by ASHRAE 189.1 (IgCC/ASHRAE 189.1) requirements as modified by Baltimore City Building, Fire and Related Code, Part XI (International Green Construction Code), all design, construction, addition, alteration, change of occupancy, relocation, replacement, repair, equipment, building site, maintenance, removal, and demolition of every structure and any appurtenances connected or attached to a structure and to the site on which the structure is located (except as otherwise exempted), must comply with the 2018 International Green Construction Code, as adopted by Ordinance 20-467, enacted, and effective immediately, December 12, 2020, and subsequently amended.

1. Other IgCC/ASHRAE 1891. requirements depend on product selections and may not be specifically identified as IgCC/ASHRAE 189.1 requirements. Compliance with IgCC/ASHRAE 189.1 requirements will be used as one criterion to evaluate substitution requests and comparable product requests.
2. Specific IgCC/ASHRAE 189.1 requirements are also included in other Sections.

1.2 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review IgCC/ASHRAE 189.1 requirements and action plans for meeting requirements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect regarding IgCC/ASHRAE 189.1 requirements that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures. Document responses as informational submittals.

1.5 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

B. Sustainable design submittals are in addition to other submittals.

1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated IgCC/ASHRAE 189.1 requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

C. IgCC/ASHRAE 189.1 Documentation Submittals:

1. Material Selection: Product Data for salvaged, recycled, recyclable, bio-based, and regional materials showing compliance with requirements. Tabulate cost for building materials used in the Project and indicate those that are salvaged, recycled, recyclable, bio-based, or regional. Include summary of building materials tabulation, showing compliance with requirement and the following:

    a. Receipts for salvaged materials, indicating sources and mass, volume, or cost as applicable.
    b. Product Data and certification letter from product manufacturers for recyclable materials. Include statement indicating cost.
    c. Product Data and certification letter from product manufacturers indicating percentage by weight of recycled content for products having recycled content. Include statement indicating cost.
    d. Product Data and certification letter from product manufacturers for bio-based materials. Include chain-of-custody certificates for products containing certified wood. Include statement indicating cost.
    e. Product Data for indigenous materials indicating location of material manufacturer and point of extraction, harvest, or recovery for raw materials. Include statement indicating distances from Project site, modes of transportation, and cost.

2. Construction Waste Management: Comply with Section 017419 "Construction Waste Management and Disposal."
3. Indoor-Air Quality (IAQ) During Construction:

    a. Construction IAQ management plan.
    b. Product Data for temporary filtration media.
    c. Product Data for filtration media used during occupancy.

4. Material Emissions and Pollutant Control: Product Data for the following, indicating compliance with requirements:

    a. Composite wood products.
    b. Adhesives and sealants.
    c. Paints and coatings.
    d. Flooring.
    e. Acoustical ceilings and wall systems.
    f. Insulation.

1.6 INFORMATIONAL SUBMITTALS

A. Action Plans: Submit the following action plans within seven days of date established for commencement of the Work, indicating how requirements will be met.

1. Material Selection Plan: List of proposed materials. Tabulate anticipated mass, volume, or cost for proposed building materials and indicate those that are used, recycled, recyclable, bio-based, or indigenous. Include summary of proposed building materials tabulation, showing compliance with requirement.
2. Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
3. Material Emissions and Pollutant Control Plan: List of proposed products. Indicate each product that complies with criteria, each product that does not, and anticipated quantities of each that will be used. Include calculations showing that percentage of noncompliant products will not exceed allowable limit.
4. Construction IAQ management plan.

B. Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction activities with action plans.

C. IAQ test report.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to comply with requirements in this Section for material selection and for material emissions and pollutant control. Although other Sections may specify some requirements for material selection and for material emissions and pollutant control, the Contractor provides additional materials and procedures necessary to comply with requirements.

2.2 MATERIAL EMISSIONS AND POLLUTANT CONTROL

A. Composite Wood Products: Formaldehyde emission rates not greater than the following when tested according to ASTM D6007 or ASTM E1333.

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.
3. Medium-Density Fiberboard More Than 5/16 Inch Thick: 0.11 ppm.
4. Medium-Density Fiberboard 5/16 Inch or Less in Thickness: 0.13 ppm.

B. Adhesives and Sealants Inside the Weatherproofing System: Comply with either of first two subparagraphs below:

1. Comply with VOC emissions requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

Emissions from Indoor Sources Using Environmental Chambers." Do not exceed formaldehyde emissions of 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.

2. Do not exceed VOC content limits of authorities having jurisdiction and the following:

    a. Carpet Adhesives: 50 g/L.
    b. Carpet Pad Adhesives: 50 g/L.
    c. Wood Flooring Adhesive: 100 g/L.
    d. Rubber Floor Adhesives: 60 g/L.
    e. Subfloor Adhesives: 50 g/L.
    f. Ceramic Tile Adhesives: 65 g/L.
    g. VCT and Asphalt Tile Adhesives: 50 g/L.
    h. Gypsum Board and Panel Adhesives: 50 g/L.
    i. Cove Base Adhesives: 50 g/L.
    j. Multipurpose Construction Adhesives: 70 g/L.
    k. Structural Glazing Adhesives: 100 g/L.
    l. Single-Ply Roof Membrane Adhesive: 250 g/L.
    m. Architectural Sealants: 250 g/L.
    n. Sealant Primers for Nonporous Substrates: 250 g/L.
    o. Sealant Primers for Porous Substrates: 775 g/L.
    p. Modified Bituminous Sealant Primers: 500 g/L.
    q. Other Sealant Primers: 750 g/L.
    r. CPVC Welding Compounds: 490 g/L.
    s. PVC Welding Compounds: 510 g/L.
    t. ABS Welding Compounds: 325 g/L.
    u. Plastic Cement Welding Compounds: 250 g/L.
    v. Adhesive Primer for Plastic: 550 g/L.
    w. Contact Adhesive: 80 g/L.
    x. Special-Purpose Contact Adhesives (Contact Adhesives That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
    y. Structural Wood Member Adhesives: 140 g/L.

C. Field Paints and Coatings Inside the Weatherproofing System: Comply with either of the following for VOC emissions:

1. The requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.
2. Do not exceed VOC content limits of authorities having jurisdiction and the:

    a. Flat Coatings: 50 g/L.
    b. Nonflat Coatings: 100 g/L.
    c. Nonflat - High Gloss Coatings: 150 g/L.
    d. Basement Special Coatings: 400 g/L.
    e. Bond Breakers: 350 g/L.
    f. Concrete Curing Compounds: 350 g/L.
    g. Concrete/Masonry Sealers: 100 g/L.
    h. Dry-Fog Coatings: 150 g/L.
    i. Faux Finishing Coatings: 350 g/L.
    j. Fire-Resistive Coatings: 350 g/L.

k. Floor Coatings: 100 g/L.
l. Form-Release Compounds: 250 g/L.
m. Graphic Arts Coatings (Sign Paints): 500 g/L.
n. High-Temperature Coatings: 420 g/L.
o. Industrial Maintenance Coatings: 250 g/L.
p. Low-Solids Coatings: 120 g/L.
q. Magnesite Cement Coatings: 450 g/L.
r. Mastic Texture Coatings: 100 g/L.
s. Metallic Pigmented Coatings: 500 g/L.
t. Multicolor Coatings: 250 g/L.
u. Pretreatment Wash Primers: 420 g/L.
v. Primers, Sealers, and Undercoaters: 100 g/L.
w. Reactive Penetrating Sealers: 350 g/L.
x. Recycled Coatings: 250 g/L.
y. Rust-Preventive Coatings: 250 g/L.
z. Shellacs, Clear: 730 g/L.
aa. Shellacs, Pigmented: 550 g/L.
bb. Stains: 250 g/L.
cc. Swimming Pool Coatings: 340 g/L.
dd. Tub and Tile Refinish Coatings: 420 g/L.
ee. Waterproof Membranes: 250 g/L.
ff. Wood Coatings: 275 g/L.
gg. Wood Preservatives: 350 g/L.
hh. Zinc-Rich Primers: 340 g/L.

D. Flooring: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less. Where postmanufactured coatings or applications have not been applied, concrete, ceramic and concrete tile, clay and concrete pavers, metal, and organic-free, mineral-based flooring complies with this requirement.

E. Acoustical Ceilings: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.

F. Wall Systems: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less. Where postmanufactured coatings or applications have not been applied, concrete, concrete masonry, clay masonry, gypsum plaster, ceramic and concrete tile, metal, and organic-free, mineral-based materials comply with this requirement.

G. Insulation: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 017419 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION IAQ MANAGEMENT

A. Cover or close openings in ducts and other related air-distribution component openings with tape, plastic, sheet metal, or other approved method before beginning dust-producing operations and maintain until dust-producing operations are complete.

B. Provide temporary ventilation during construction, using one or more of the following methods:

1. Natural ventilation complying with the IBC.
2. Fans that produce three air changes per hour.
3. Exhaust in work areas at not less than 0.05 cfm/sq. ft. and not less than 10 percent greater than supply air to maintain a negative pressure.

C. Air-Quality Testing: Owner will engage testing agency to perform the following:

1. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols in accordance with ASTM D5197, ASTM D5466, ASTM D6196, ASTM D6345, and ISO 7708. A minimum of one sampling point per 25,000 sq. ft. or contiguous floor area is required.
2. Concentrations of the following shall not exceed the following:

a. Particulates (PM2.5): 35 micrograms/cu. m. (24 h)
b. Particulates (PM10): 150 micrograms/cu. m. (24 h)
c. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
d. 1, 1, 1-Trichloroethane: 1000 micrograms/cu. m.
e. 1, 3-Butadiene: 20 micrograms/cu. m.
f. 1, 4-Dichlorobenzene: 800 micrograms/cu. m.
g. 1, 4-Dioxane: 3000 micrograms/cu. m.
h. 2-Propanol: 7000 micrograms/cu. m.
i. Acetaldhyde: 140 micrograms/cu. m.
j. Acrylonitrile: 5 micrograms/cu. m.
k. Benzene: 60 micrograms/cu. m.
l. t-Butyl Methyl Ether: 8000 micrograms/cu. m.
m. Carbon Disulfide: 800 micrograms/cu. m.
n. Carbon Tetrachloride: 40 micrograms/cu. m.
o. Chlorobenzene: 1000 micrograms/cu. m.
p. Chloroform: 300 micrograms/cu. m.

q. Dichloromethene: 400 micrograms/cu. m.
r. Ethybenzene: 2000 micrograms/cu. m.
s. Ethylene Glycol: 400 micrograms/cu. m.
t. Formaldehyde: 33 micrograms/cu. m.
u. n-Hexane: 7000 micrograms/cu. m.
v. Naphthalene: 9 micrograms/cu. m.
w. Phenol: 200 micrograms/cu. m.
x. Styrene: 900 micrograms/cu. m.
y. Tetrachloroethane: 35 micrograms/cu. m.
z. Toluene: 300 micrograms/cu. m.
aa. Trichloroethane: 600 micrograms/cu. m.
bb. Xylene Isomers: 700 micrograms/cu. m.
cc. Total Volatile Organic Compounds: 500 micrograms/cu. m.

3. Where carpets and fabrics with styrene butadiene rubber latex backing are installed, the following are the maximum allowable concentrations:

a. 1-Methyl-2-Pyrrolidinone: 160 micrograms/cu. m.
b. 2-Ethylhexanoic Acid: 25 micrograms/cu. m.
c. 4-Phenylcyclohexene (4-PH): 2.5 micrograms/cu. m.
d. Caprolactam: 100 micrograms/cu. m.
e. Nonanal: 13 micrograms/cu. m.
f. Octanal: 7.2 micrograms/cu. m.

4. If any maximum concentration limit is exceeded and not mitigated and successfully retested, the building shall be flushed out for 14 days with air-handling units at maximum outside air while maintaining a temperature of at least 60 deg F and a relative humidity of not more than 60 percent.

END OF SECTION 018113.33

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SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning activities.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of commissioning process test equipment, instrumentation, and tools.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 011000 "Summary" for Commissioning Authority responsibilities.
2. Section 013300 "Submittal Procedures" for submittal procedure requirements for commissioning process.
3. Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
4. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.
5. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
6. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
7. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
8. Section 280800 "Commissioning of Electronic Safety and Security" for technical commissioning requirements for electronic safety and security systems.

1.3 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

B. Basis-of-Design Document: A document prepared by Architect that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.

E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of the commissioning process is defined in Section 011000 "Summary."

F. Construction-Phase Commissioning-Process Completion: The stage of completion and acceptance of commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date construction-phase commissioning-process completion is achieved. See Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.

1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following:

    a. Completion of tests and acceptance of test results.
    b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    c. Comply with requirements in Section 017900 "Demonstration and Training."
    d. Completion and acceptance of submittals and reports.

G. Owner's Project Requirements: A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This document is prepared either by the Owner or for the Owner by the Architect or Commissioning Authority.

H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.4 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedure general requirements for commissioning process.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors performing the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the Construction Schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for the Construction Schedule general requirements for commissioning process.
3. Contractor personnel and subcontractors participating in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. List test instrumentation, equipment, and monitoring devices. Include the following information:

1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
2. Brief description of intended use.
3. Calibration record showing the following:

a. Calibration agency, including name and contact information.
b. Last date of calibration.
c. Range of values for which calibration is valid.
d. Certification of accuracy.
e. Certification for calibration equipment traceable to NIST.
f. Due date of the next calibration.

F. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.

2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

G. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.5 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction-Phase Commissioning Completion, include the following:

a. Pre-startup reports.
b. Approved test procedures
c. Test data forms, completed and signed.
d. Progress reports.
e. Commissioning issue report log.
f. Commissioning issue reports showing resolution of issues.
g. Correspondence or other documents related to resolution of issues.
h. Other reports required by commissioning process.
i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction-Phase Commissioning Completion.
j. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction-Phase Commissioning Process Completion.

C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:

1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
2. Calibrated and certified.

    a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but within six months of initial use on Project. Calibration tags shall be permanently affixed.
    b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.

3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.

3. Include minor tabs for each test.
4. Within each minor tab, include the following:

    a. Test specification.
    b. Pre-startup reports.
    c. Approved test procedures.
    d. Test data forms, completed and signed.
    e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

A. Construction checklists cannot modify or conflict with the Contract Documents.

B. Create construction checklists based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.

1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
2. Included optional features.
3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
4. Installation Checks:

    a. Location according to Drawings and approved Shop Drawings.
    b. Configuration.
    c. Compliance with manufacturers' written installation instructions.
    d. Attachment to structure.
    e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
    f. Utility connections are of the correct characteristics, as applicable.

g. Correct labeling and identification.
h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.

E. Performance Tests:

1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, deferred construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:

1. Identify deferred construction checklists by number and title.
2. Provide a target schedule for completion of deferred construction checklists.
3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.

G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, delayed construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:

1. Identify delayed construction checklist by construction checklist number and title.
2. Provide a target schedule for completion of delayed construction checklists.
3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning process with the Construction Schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.

1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.

    a. General Inspection: Level II.
    b. Special Inspection: Level S-1.
    c. Acceptance Quality Limit (AQL) of 1.5.

2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning-Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.
2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.
2. Obtain, assemble, and submit commissioning documentation.
3. Conduct periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
5. Review and comment on preliminary test procedures and data forms.
6. Report inconsistencies and issues in system operations.
7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by Owner's witness.

10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.

B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published Commissioning Schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning process.

C. Construction Checklists:

1. Complete construction checklists as Work is completed.
2. Distribute construction checklists to installing contractors before they start work.
3. Installers:

    a. Verify installation using approved construction checklists as Work proceeds.
    b. Complete and sign construction checklists weekly for work performed during the preceding week.

4. Provide Commissioning Authority access to construction checklists.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.

F. Test Procedures and Test Data Forms:

1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.

2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
3. Completed test data forms are the official records of the test results.
4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

    a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
    b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.

6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.

    a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.

7. False load test requirements are specified in related sections.

    a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction-Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction-Phase Commissioning Process Completion as follows:

    a. Identify deferred tests by number and title.
    b. Provide a target schedule for completion of deferred tests.

2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. Include the following in the request for Certificate of Construction-Phase Commissioning Process Completion:

    a. Identify delayed tests by test number and title.

b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.

2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

   a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
   b. Submit commissioning compliance issue report 24 hours of the test.
   c. Determine the cause of the failure.
   d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.

   a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
   b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
   c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
   d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.

6. Diagnose and correct failed test demonstrations as follows:

a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
c. Record the results of each step of the diagnostic procedure.
d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
e. Determine and record corrective measures.
f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

7. Retest:

a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
b. For each repeated test demonstration, submit a new test data form, marked "Retest."

8. Do not correct commissioning compliance issues during test demonstrations.

a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than five minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. Construction Checklists:

a. Material checks.
b. Installation checks.
c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
d. Performance Tests:

1) Static tests, as appropriate.

2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
3) Equipment and assembly performance tests.
4) System performance tests.
5) Intersystem performance tests.

2. Commissioning tests.

B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.7 SCHEDULING

A. Commence commissioning process as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule. See Section 013200 "Construction Progress Documentation."

1. Include detailed commissioning activities in monthly updated Construction Schedule and short-interval schedule submittals.
2. Schedule the start date and duration for the following commissioning activities:

a. Submittals.
b. Preliminary operation and maintenance manual submittals.
c. Installation checks.
d. Startup, where required.
e. Performance tests.
f. Performance test demonstrations.
g. Commissioning tests.
h. Commissioning test demonstrations.

3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.

C. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning process.
2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

D. Owner's Witness Coordination:

1. Coordinate Owner's witness participation via Architect.
2. Notify Architect of commissioning schedule changes at least two work days in advance for activities requiring the participation of Owner's witness.

3.8 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

   a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
   b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
   c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
   d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
   e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:

   a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
   b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
   c. Signatures of individuals performing and witnessing tests.
   d. Data trend logs accumulated overnight from the previous day of testing.

3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:

    a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
    b. Action distribution list.
    c. Report date.
    d. Test number and description.
    e. Equipment identification and location.
    f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
    g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
    h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
    i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
    j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
    k. Schedule for retesting.

4. Weekly progress reports include information for tests conducted since the preceding report and the following:

    a. Completed data forms.
    b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
    c. Activities scheduled but not conducted per schedule.
    d. Commissioning compliance issue report log.
    e. Schedule changes for remaining Commissioning-Process Work, if any.

5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.

    a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
    b. Attach to the data form printed trend log data collected during the test or test demonstration.
    c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.

6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."

    a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.9 CERTIFICATE OF CONSTRUCTION-PHASE COMMISSIONING PROCESS COMPLETION

A. When Contractor considers that construction-phase commissioning process, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning process.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction-phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction-Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction-Phase Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction-phase commissioning process completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction-phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction-Phase Commissioning Process Completion that shall establish the date of completion of construction-phase commissioning process. Certificate of Construction-Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 019113

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SECTION 024119 - SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
4. Section 028100 “Transportation and Disposal of Hazardous Materials”
5. Section 028216 “Asbestos Specs”
6. Section 028313 “Lead in Construction”
7. Section 028416 “Handling of Lighting Ballasts and Lamps Containing PCBs and Mercury”

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Survey of Existing Conditions: Submit survey.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

D. Schedule of selective demolition activities with starting and ending dates for each activity.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will not occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

1. Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is included in Section 003126 "Existing Hazardous Material Information" for review and use. Examine report to become aware of locations where hazardous materials are present.

    a. Hazardous material remediation is specified in:
        1) Section 028100 “Transportation and Disposal of Hazardous Materials”
        2) Section 028216 “Asbestos Specs”
        3) Section 028313 “Lead in Construction”
        4) Section 028416 “Handling of Lighting Ballasts and Lamps Containing PCBs and Mercury”

E. On-site sale of removed items or materials is not permitted.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video. Comply with Section 013233 "Photographic Documentation."

1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and cleaned and reinstalled in their original locations after selective demolition operations are complete.

C. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

3. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

    a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

4. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

    a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
    b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL

A. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them in accordance with Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 028100 - TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. IATA DGR (2013) Dangerous Goods Regulations Radioactive Waste (HTRW) Projects
2. 40 CFR 261 Identification and Listing of Hazardous Waste
3. 40 CFR 262 Standards Applicable to Generators of Hazardous Waste
4. 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste
5. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
6. 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
7. 40 CFR 266 Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
8. 40 CFR 268 Land Disposal Restrictions
9. 40 CFR 270 EPA Administered Permit Programs: The Hazardous Waste Permit Program
10. 40 CFR 279 Standards for the Management of Used Oil
11. 40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan
12. 40 CFR 302 Designation, Reportable Quantities, and Notification
13. 40 CFR 61 National Emission Standards for Hazardous Air Pollutants
14. 40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
15. 49 CFR 107 Hazardous Materials Program Procedures
16. 49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
17. 49 CFR 173 Shippers - General Requirements for Shipments and Packagings
18. 49 CFR 178 Specifications for Packagings

1.2 DEFINITIONS

A. Hazardous Material: A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

B. Hazardous Waste: A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

1.3 REQUIREMENTS

A. The following materials will be properly removed, packaged, transported and disposed of as part of the project:

1. 9”x9” floor title of various colors throughout the lower level
2. Mastic associated with 12”x12” throughout the lower level
3. Black sink insulation
4. Exterior window caulk
5. Exterior vent caulk
6. Exterior expansion joint mastic
7. Exterior façade mastic
8. Wood Doors (Assumed)
9. Mirror Mastic (Assumed)
10. Roofing Materials (Assumed)

B. Lead-based paint was detected on ceramic wall tiles, ceramic sinks in Restrooms and metal coated utility sinks found in the boiler room and janitor closets. Any disturbance to lead-based paint should be performed in accordance with OSHA “Lead in Construction Rule (29 CFR 1926.62)” and the Lead Renovation, Repair and Painting Rule. Waste should be analyzed by toxicity characteristic leaching procedure (TCLP).

1.4 SUBMITTALS

A. Submit the following in accordance with Section 013300 SUBMITTAL PROCEDURES:

1. Product Data
    a. Onsite Hazardous Waste Management
    b. Notices of Non-Compliance and Notices of Violation
    c. Packaging Notifications
2. Test Reports
    a. Recordkeeping
    b. Spill Response
    c. Exception Report
3. Certificates
    a. Certification
    b. Security Plan
    c. Transportation and Disposal Coordinator
    d. Training
    e. EPA Offsite Policy
    f. Certificates of Disposal
    g. Shipping Documents and Packagings Certification
    h. Waste Minimization

1.5 QUALITY ASSURANCE

A. Transportation and Disposal Coordinator: Designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC shall serve as the single point of contact for all environmental regulatory matters and shall have overall responsibility for total environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of ladings, exception and discrepancy reports; and all other environmental documentation. The TDC shall have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste and have been Department of Transportation certified under 49 CFR 172, Subpart H.

B. Training: The Contractor's hazardous materials employees shall be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with the Site Safety and Health Plan. The Contractor's employees transporting hazardous materials or preparing hazardous materials for transportation, including samples, shall be trained, tested,

and certified in accordance with 49 CFR 172, Subpart H, including security awareness and any applicable security plans. Where shipment of hazardous materials by air may be occurring, such as for sample shipments, the Contractor's hazardous material employees shall also be trained on IATA DGR. Contractor employees making determinations that shipments do not constitute DOT regulated hazardous materials shall also be trained, tested, and certified in accordance with 49 CFR 172, Subpart H.

C. Certification: The contractor and/or subcontractors transporting hazardous materials shall possess a current certificate of registration issued by the Research and Special Programs Administration (RSPA), U.S. Department of Transportation, when required by 49 CFR 107, Subpart G. Submit copies of the certificates or written statements certifying exemption from these requirements.

D. Laws and Regulations Requirements: Work shall meet or exceed the minimum requirements established by Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and compliance with amendments is required as they become effective. In the event that compliance exceeds the scope of work or conflicts with specific requirements of the contract, notify the Contracting Officer immediately.

PART 2 – PRODUCTS

2.1 MATERIALS

Provide all the materials required for the packaging, labeling, marking, placarding and transportation of hazardous wastes and hazardous materials in conformance with Department of Transportation standards and the State of Maryland. Details in this specification shall not be construed as establishing the limits of the Contractor's responsibility.

A. Packaging: Provide bulk and non-bulk containers for packaging hazardous materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 8. Bulk and non-bulk packaging shall meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section .101. Each packaging shall conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section .101, and shall be compatible with the material to be packaged as required by 40 CFR 262. Also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers, etc. Sorbent materials shall not be capable of reacting dangerously with, being decomposed by, or being ignited by the hazardous materials being packaged. Additionally, sorbents used to treat free liquids to be disposed of in landfills shall be non-biodegradable as specified in 40 CFR 264, Section .314. In addition, packaging notifications will be provided to DGS in accordance with 49 CFR 172, Section .178.2(c) regarding type and dimensions of closures, including gaskets, needed to satisfy performance test requirements.

B. Markings: Provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D and 40 CFR 262, Section .32 (for hazardous waste)40 CFR 761, Section .45 (for PCBs),40 CFR 61, Section .149(d) (for asbestos). Markings shall be capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

C. Labeling: Provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 6. Labels shall meet design specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labels shall be durable and weather resistant and capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

D. Placards: For each offsite shipment of hazardous material/waste, provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F. Placards shall be provided for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and shall meet design requirements specified in 49 CFR 172, Subpart F.

E. Spill Response Materials: Provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials shall be available at all times in which hazardous materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of material being handled.

2.2 EQUIPMENT AND TOOLS

A. Provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

PART 3 - EXECUTION

3.1 ONSITE HAZARDOUS WASTE MANAGEMENT

These paragraphs apply to building related waste only. Contractors are prohibited by 10 U.S.C. 2692 from storing Contractor owned waste onsite for any length of time. The Contractor is responsible for ensuring compliance with all Federal, state, and local hazardous waste laws and regulations and shall verify those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. Identify hazardous wastes using criteria set forth in 40 CFR 261 or all applicable state and local laws, regulations, and ordinances. When accumulating hazardous waste onsite, comply with generator requirements in 40 CFR 262and any applicable state or local law or regulations. Onsite accumulation times shall be restricted to applicable time frames referenced in 40 CFR 262, Section .34 and any applicable state or local law or regulation. Accumulation start dates shall commence when waste is first generated (i.e. containerized or otherwise collected for discard). Only use containers in good condition and compatible with the waste to be stored. Ensure containers are closed except when adding or removing waste, and immediately mark all hazardous waste containers with the words "hazardous waste" and other information required by 40 CFR 262, Section .32 and any applicable state or local law or regulation as soon as the waste is containerized. An additional marking shall be placed on containers of "unknowns" designating the date sampled, and the suspected hazard. Inspect containers for signs of deterioration and for responding to any spills or leaks. Inspect all hazardous waste areas weekly and provide written documentation of the inspection. Include date and time of inspection, name of individual conducting the inspection, problems noted, and corrective actions taken on the inspection logs.

A. Hazardous Waste Classification: Identify, in consultation with the DGS, all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or any applicable state or local law or regulation. Also identify all applicable treatment standards in 40 CFR 268 and state land disposal restrictions and make a determination as to whether or not the waste meets or exceeds the standards. Waste profiles, analyses, classification and treatment standards information shall be submitted to Contracting Officer for review and approval.

B. Management Plan: Prepare a plan detailing the manner in which hazardous wastes will be managed and describing the types and volumes of hazardous wastes anticipated to be managed as well as the management practices to be utilized. The plan shall identify the method to be used to ensure accurate piece counts and/or weights of shipments; shall identify waste minimization methods; shall propose facilities to be utilized for treatment, storage, and/or disposal; shall identify areas onsite where hazardous wastes are to be handled; and shall identify whether transfer facilities are to be utilized; and if so, how the wastes will be tracked to ultimate disposal. Submit the plan prior to start of work. Written documentation of weekly hazardous waste inspections shall be submitted on a monthly basis.

3.2 OFFSITE HAZARDOUS WASTE MANAGEMENT

Use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265. Offsite treatment, storage, and/or disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air) shall not be used. Submit Notices of Non-Compliance and Notices of Violation by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. Immediately provide copies of such notices to the Contracting Officer. Also furnish all relevant documents regarding the incident and any information requested by the Contracting Officer and coordinate its response to the notice with the Contracting Officer or the designated representative prior to submission to the notifying authority. Also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

A. Treatment, Storage, and/or Disposal Facility and Transporter: Provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information shall be contained in the Hazardous Waste Management Plan and shall be approved by the Contracting Officer prior to waste disposal.

B. Status of the Facility: Facilities receiving hazardous waste shall be permitted in accordance with 40 CFR 270 or operating under interim status in accordance with 40 CFR 265 requirements or permitted by a state authorized by the Environmental Protection Agency to administer the RCRA permit program. Additionally, prior to using a TSD Facility, contact the EPA Regional Offsite Coordinator specified in 40 CFR 300, Section .440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Offsite policy and submit this information to the Contracting Officer.

C. Shipping Documents and Packagings Certification: Prior to shipment of any hazardous material offsite and a minimum of 7 days prior to anticipated pickup, provide for review written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation and EPA

requirements. Furnish designated disposal facility packaging assurances by the not later than 35 days after acceptance of the shipment. The Contractor's TDC shall also provide written certification regarding waste minimization efforts documenting that efforts have been taken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

D. Transportation: Prior to conducting hazardous materials activities, the Contractor responsible for pre-transportation activities shall either certify to the Contracting Officer that a Security Plan is in place which meets the requirements of 49 CFR 172, Subpart I or in the event that the types or amounts of hazardous materials are excluded from the security planning requirements, a written statement to that effect detailing the basis for the exception. Use manifests for transporting hazardous wastes as required by 40 CFR 263 or any applicable state or local law or regulation. Transportation shall comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. Prepare hazardous waste manifests for each shipment of hazardous waste shipped offsite. Manifests shall be completed using instructions in 40 CFR 262, Subpart B and any applicable state or local law or regulation. Submit manifests and waste profiles to Contracting Officer for review and approval. Prepare land disposal restriction notifications as required by 40 CFR 268 or any applicable state or local law or regulation for each shipment of hazardous waste. Submit notifications with the manifest to the Contracting Officer for review and approval.

E. Treatment and Disposal of Hazardous Waste: The hazardous waste shall be transported to an approved hazardous waste treatment, storage, or disposal facility within 90 days of the accumulation start date on each container. Ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. Ensure wastes are treated to meet land disposal treatment standards in 40 CFR 268 prior to land disposal. Propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer. Submit Certificates of Disposal documenting the ultimate disposal, destruction or placement of hazardous wastes, CERCLA remediation waste, polychlorinated biphenyls (PCBs), and/or asbestos within 180 days of initial shipment. Receipt of these certificates will be required for final payment.

3.3 RADIOACTIVE MATERIALS MANAGEMENT

In consultation with the generator, evaluate, prior to shipment of any material offsite, whether the material is regulated as a hazardous waste in addition to being regulated as a radioactive material; this shall be done for the purpose of determining proper shipping descriptions, marking requirements, etc., as described below.

A. Identification of Proper Shipping Names: Use 49 CFR 172, Section .101 to identify proper shipping names for each hazardous material (including hazardous wastes) to be shipped offsite. Submit proper shipping names to the Contracting Officer in the form of draft shipping documents for review and approval.

B. Packaging, Labeling, and Marking: Package, label, and mark hazardous materials/wastes using the specified materials and in accordance with the referenced authorizations. Mark each container of hazardous waste of 110 gallons or less with the following:

"HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal.

If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.

Generator's name _____

Manifest Document Number _____".

C. Shipping Documents: Ensure that each shipment of hazardous material sent offsite is accompanied by properly completed shipping documents. This includes shipments of samples that may potentially meet the definition of a Department of Transportation regulated hazardous material.

1. PCB Waste Shipment Documents: Prepare hazardous waste manifests for each shipment of PCB waste shipped offsite. Complete manifests using instructions in 40 CFR 761, Sections .207 and .208 and all other applicable requirements. Submit documents to Contracting Officer for review and approval.

2. Asbestos Waste Shipment Documents: Prepare waste shipment records, as required by 40 CFR 61, for shipments of asbestos. Submit waste shipment records to the Contracting Officer for review and approval. Waste shipment records shall be signed by the Contractor.

3. Other Hazardous Material Shipment Documents: Prepare a bill of lading for each shipment of hazardous material which is not accompanied by a hazardous waste manifest or asbestos waste shipment record which fulfills the shipping paper requirements. The bill of lading shall satisfy the requirements of 49 CFR 172, Subpart C, and 40 CFR 279 if shipping used oil and any applicable state or local law or regulation and shall be submitted to the Contracting Officer for review and approval. For laboratory samples and treatability study samples, prepare bills of lading and other documentation as necessary to satisfy conditions of the sample exclusions in 40 CFR 261, Section .4(d) and (e) and any applicable state or local law or regulation. Bill of ladings requiring shipper's certifications will be signed by the Contractor.

3.4 OBTAINING EPA ID NUMBERS

Complete EPA Form 8700-12, Notification of Hazardous Waste Activity, and submit to the Contracting Officer for review and approval. Allow a minimum of 30 days for processing the application and assigning the EPA ID number. Shipment shall be made no earlier than one week after receipt of the EPA ID number.

3.5 SPECIAL REQUIREMENTS FOR ASBESTOS WASTES

If work involves asbestos containing wastes, manage these wastes in accordance with specification Section 02 82 16.

3.6 WASTE MINIMIZATION

Minimize the generation of hazardous waste to the maximum extent practicable and take all necessary precautions to avoid mixing clean and contaminated wastes. Identify and evaluate

recycling and reclamation options as alternatives to land disposal. Requirements of 40 CFR 266 shall apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals. Submit written certification that waste minimization efforts have been undertaken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

3.7 RECORDKEEPING

Maintain adequate records to support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports; maintain asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract; and maintain bill of ladings for a minimum of 375 days from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract. Submit information necessary to file state annual or EPA biennial reports for all hazardous waste transported, treated, stored, or disposed of under this contract. Do not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. The submittal shall contain all the information necessary for filing of the formal reports in the form and format required by the governing Federal or state regulatory agency. A cover letter shall accompany the data to include the contract number, Contractor name, and project location. In the events that a manifest copy documenting receipt of hazardous waste at the treatment storage and disposal facility is not received within 35 days of shipment initiation, or that a manifest copy documenting receipt of PCB waste at the designated facility is not received within 35 days of shipment initiation, prepare and submit an exception report to the Contracting Officer within 37 days of shipment initiation.

3.8 SPILL RESPONSE

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. Any direction from the Contracting Officer concerning a spill or release shall not be considered a change under the contract. If the spill exceeds a reporting threshold, follow the pre-established procedures for immediate reporting to the Contracting Officer. Comply with all applicable requirements of Federal, state, or local laws or regulations regarding any spill incident.

3.9 EMERGENCY CONTACTS

The Contractor is responsible for complying with the emergency contact provisions in 49 CFR 172, Section .604. Whenever the Contractor ships hazardous materials, provide a 24 hour emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. The phone shall be monitored on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. Ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. Designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

A. The name of the emergency coordinator.

B. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.

C. The telephone number of the local fire department.

D. The location of fire extinguishers and spill control materials.

Attachment A SAMPLE OFF-SITE POLICY CERTIFICATION MEMO	
Project/Contract #:	
Waste Stream:	
Primary TSD Facility, EPA ID # and Location:	
Alter. TSD Facility, EPA ID # and Location:	
EPA Region	Contact
I	(617) 918-1752
II	(212) 637-4130
III	(214) 814-5267
IV	(404) 562-8591
V	(312) 353-8207
VI	(214) 665-2282
VII	(913) 551-7154
VIII	(303) 312-6419
IX	(415) 972-3304
X	(206) 553-2859
EPA representative contacted:	
EPA representative phone number:	
Date contacted:	

Attachment A SAMPLE OFF-SITE POLICY CERTIFICATION MEMO	
Comment:	
The above EPA representative was contacted on _____. As of that date the above sites were considered acceptable in accordance with the Off-Site Policy in 40 CFR 300.440.	
Date:	Signature:
Phone number:	

END OF DOCUMENT 028100

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SECTION 028216 - ASBESTOS CONTAINING MATERIALS

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel
2. ASSE Z9.2 (2012) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems
3. ASTM C732 (2006; R 2012) Aging Effects of Artificial Weathering on Latex Sealants
4. ASTM D2794 (1993; R 2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
5. ASTM D522/D522M (2014) Mandrel Bend Test of Attached Organic Coatings
6. ASTM E119 (2014) Standard Test Methods for Fire Tests of Building Construction and Materials
7. ASTM E1368 (2014) Visual Inspection of Asbestos Abatement Projects
8. ASTM E736 (2000; R 2011) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
9. ASTM E84 (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials
10. ASTM E96/E96M (2014) Standard Test Methods for Water Vapor Transmission of Materials
11. EPA 560/5-85-024 (1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)
12. 29 CFR 1926.103 Respiratory Protection
13. 29 CFR 1926.1101 Asbestos
14. 29 CFR 1926.200 Accident Prevention Signs and Tags
15. 29 CFR 1926.51 Sanitation
16. 29 CFR 1926.59 Hazard Communication
17. 40 CFR 61-SUBPART A General Provisions
18. 40 CFR 61-SUBPART M National Emission Standard for Asbestos
19. 40 CFR 763 Asbestos
20. UL 586 (2009; Reprint Sep 2014) Standard for High-Efficiency Particulate, Air Filter Units
21. COMAR 26.13 Chapters .01-.13 Disposal of Controlled Hazardous Substances

1.2 DEFINITIONS

A. Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter.

B. Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.

C. Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

D. Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, has EPA/State certification/license as a "Building Inspector".

E. Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

F. Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

G. Class III Asbestos Work: Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

H. Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction

I. Clean Room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

J. Competent Person: In addition to the definition in 29 CFR 1926.32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926.1101, electing the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; has EPA/State certification/license as a "Contractor/Supervisor".

K. Contractor/Supervisor: Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; has EPA/State certification as a "Contractor/Supervisor".

L. Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.

M. Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

N. Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

O. Disposal Bag: A 0.15 mm 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

P. Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 1.5 m 60 inches in length and width in order to access a building component.

Q. Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.

R. Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.

S. Friable ACM: A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

T. Glovebag: Not more than a 1.5 by 1.5 m 60 by 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

U. High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

V. Intact: ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.

W. Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

X. Negative Initial Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

Y. NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.

Z. Nonfriable ACM: A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

AA. Nonfriable ACM (Category I): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos.

BB. Nonfriable ACM (Category II): A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos.

CC. Permissible Exposure Limits (PELs):

1. PEL-Time Weighted Average (TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8 hour time weighted average (TWA).

2. PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

DD. Regulated Area: An OSHA term defined in 29 CFR 1926.1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

EE. Removal: All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

FF. Repair: Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates.

GG. Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

HH. Thermal System Insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

II. Transite: A generic name for asbestos cement wallboard and pipe.

JJ. Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 SYSTEM DESCRIPTION

This section covers all operations in which asbestos-containing materials (ACM) are encountered. These procedures and equipment are required to protect workers and building occupants from airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class I and Class II work operations. This section also includes containment, storage, transportation and disposal of the generated ACM wastes. Submit Detailed Drawings containing descriptions, and site layout to include worksite containment area(s), local exhaust systems locations, decontamination units and load-out units, other temporary waste

storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

1. Abatement Work Tasks: The specific ACM to be abated in Forest Park Branch Library includes:

   A. 9”x9” floor title of various colors throughout the lower level
   B. Mastic associated with 12”x12” throughout the lower level
   C. Black sink insulation
   D. Exterior window caulk
   E. Exterior vent caulk
   F. Exterior expansion joint mastic
   G. Exterior façade mastic
   H. Wood Doors (Assumed)
   I. Mirror Mastic (Assumed)
   J. Roofing Materials (Assumed)

2. Unexpected Discovery of Asbestos: For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, notify the Baltimore County Public Schools Project Manager (PM) who will have the option of ordering up to 5 bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM. If the asbestos content is less than 10 percent, as determined by a method other than point counting, the asbestos content shall be verified by point counting. Any additional components identified as ACM that have been approved by the PM for removal shall be removed and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and holds Maryland accreditation as a "Building Inspector". Sample results will be documented in accordance with COMAR and AHERA requirements.

1.4 SUBMITTALS

A. Baltimore County Public Schools approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

   1. SD-02 Shop Drawings

   2. Detailed Drawings; G

   3. SD-03 Product Data

   4. Asbestos Waste Shipment Records; G

   5. Weight Bills and Delivery Tickets; G *Required for Payment

   6. Encapsulants

7. Respiratory Protection Program
8. Cleanup and Disposal; G
9. Qualifications; G
10. Training Program
11. Licenses, Permits and Notifications; G
12. Asbestos Abatement Management Plan; G
13. SD-06 Test Reports
14. Exposure Assessment and Air Monitoring; G
15. Local Exhaust System Function Test Reports
16. SD-07 Certificates
17. Local Exhaust System
18. Encapsulants; G
19. Medical Surveillance Requirements

1.5 QUALITY ASSURANCE

In addition to detailed requirements of this specification, work performed under this contract shall comply with applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos material apply: State of Maryland.

A. Submit a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH; independent testing laboratory; all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. Include in the report an organization chart showing the Contractor's staff organization chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. Include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61, Subpart M, and the federal, state and local requirements for those asbestos abatement activities that they will be involved in."

B. Specific Requirements: Designate in writing, personnel meeting the following qualifications:

1. Asbestos Abatement Contractor: Certified/licensed by Maryland Department of the Environment to perform asbestos-related activities.

2. Designated Competent Person: Qualified in accordance with 29 CFR 1926.32 and 29 CFR 1926.1101, has EPA MAP "Contractor/Supervisor" training accreditation, has EPA/Maryland accreditation as a "Contractor/Supervisor" and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan (APP) and Asbestos Hazard Abatement Plan (AHAP). Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, Maryland accreditation number with the employee "Certificate of Worker Acknowledgment". Submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

3. Project and Other Supervisors: Have EPA MAP "Contractor/Supervisor" training accreditation. Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, EPA/State accreditation with the employee "Certificate of Worker Acknowledgment". Also submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 year on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.

4. Designated Industrial Hygienist: Resume for the Industrial Hygienist (IH) selected to prepare the Contractor's AHAP, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board eligible (meets all education and experience requirements) as determined and documented by the American Board of Industrial Hygiene (ABIH), has EPA MAP "Contractor/Supervisor" training accreditation, has EPA/Maryland accreditation, and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training and EPA/State certification/license with the employee "Certificate of Worker Acknowledgment". The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. The Designated IH shall be onsite at all times for the duration of asbestos activities and shall be available for emergencies. In addition, submit resumes of additional IH's and

industrial hygiene technicians (IHT) who will be assisting the Designated IH in performing onsite tasks. IHs and IHTs supporting the Designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience. Indicate the formal reporting relationship between the Designated IH and the support IHs and IHTs, the Designated Competent Person, and the Contractor.

5. Asbestos Abatement Workers: Meet the requirements contained in 29 CFR 1926.1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment". Training documentation is required for each employee who will perform OSHA Class I and Class II asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.

6. Independent Testing Laboratory: identify the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

    a. Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926.1101, OSHA method ID-160, the most current version of NIOSH 94-113 Method 7400 as shown in Table 3 at the end of this Section. The laboratory shall be currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or by participating in the AIHA PAT Program, and being judged proficient in counting samples.

    b. Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts with demonstrated proficiency to conduct PLM analyses.

    c. Transmission electron microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts with demonstrated proficiency under NVLAP.

    d. PCM/TEM: The laboratory is fully equipped and each analyst is proficient in conducting PCM and TEM analysis of airborne samples using NIOSH 94-113 Method 7400 PCM and NIOSH 94-113 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

7. Disposal Facility, Transporter: Written evidence that the landfill to be used is approved for asbestos disposal by the USEPA and the state and local regulatory agencies having jurisdiction. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste shall be provided. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections .154 or .155, as required in 40 CFR 61 150(b), and other applicable state or local requirements.

8. Federal, State or Local Citations on Previous Projects: The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

9. Preconstruction Conference: The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Baltimore County Public Schools PM prior to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted APP to include the AHAP and AHAs appendices. Deficiencies in the APP will be discussed. Onsite work shall not begin until the APP has been accepted.

1.6 SAFETY

Prepare a written comprehensive site-specific Accident Prevention Plan (APP) at least 30 days prior to the preconstruction conference. The APP shall be in accordance with the format and requirements presented below. The APP shall incorporate an Asbestos Hazard Abatement Plan (AHAP), and Activity Hazard Analyses (AHAs) as separate appendices into one site-specific document. The APP shall take into consideration all the individual asbestos abatement work tasks.

A. An Accident Prevention Plan (APP) is a safety and health policy and program document. The following areas are typically addressed in an APP, but an APP shall be job-specific and shall also address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the employer’s overall safety and health program, and a copy shall be available on the work site. Any portions of the overall safety and health program that are referenced in the APP shall be included as appropriate.

   1. SIGNATURE SHEET. Title, signature, and phone number of the following:

      a. Plan preparer (Qualified Person, Competent Person, such as corporate safety staff person, QC);

      b. Plan must be approved, by company/corporate officers authorized to obligate the company;

c. Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional, project QC). Provide concurrence of other applicable corporate and project personnel (Contractor).

2. BACKGROUND INFORMATION. List the following:

a. Contractor;

b. Contract number;

c. Project name;

d. Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

3. STATEMENT OF SAFETY AND HEALTH POLICY. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.

4. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:

a. A statement of the employer's ultimate responsibility for the implementation of his safety program;

b. Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes. Qualifications shall include the OSHA 30-hour course or equivalent course areas as listed here:

i. OSH Act/General Duty Clause;

ii. 29 CFR 1904, Recordkeeping;

iii. Subpart C: General Safety and Health Provisions, Competent Person;

iv. Subpart D: Occupational Health and Environmental Controls, Citations and Safety Programs;

v. Subpart E: PPE, types and requirements for use;

vi. Subpart F: understanding fire protection in the workplace;

vii. Subpart K: Electrical;

viii. Subpart M: Fall Protection;

ix. Rigging, welding and cutting, scaffolding, excavations, concrete and masonry, demolition; health hazards in construction, materials handling, storage and

disposal, hand and power tools, motor vehicles, mechanized equipment, marine operations, steel erection, stairways and ladders, confined spaces or any others that are applicable to the work being performed.

c. The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached. The District SOHO will review the qualifications for acceptance;

d. Requirements that no work shall be performed unless a designated competent person is present on the job site;

e. Requirements for pre-task safety and health analysis;

f. Lines of authority;

g. Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

h. Provide written company procedures for holding managers and supervisors accountable for safety.

5. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating safety activities with other employers on the job site:

a. Identification of subcontractors and suppliers (if known);

b. Safety responsibilities of subcontractors and suppliers.

6. TRAINING.

a. Requirements for new hire safety orientation training at the time of initial hire of each new employee.

b. Requirements for mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, confined space entry, vehicle operator, HAZWOPER training and certification, PPE) and any requirements for periodic retraining/recertification.

c. Procedures for periodic safety and health training for supervisors and employees.

d. Requirements for emergency response training.

7. SAFETY AND HEALTH INSPECTIONS.

a. Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., SSHO, industrial hygienist, PM, safety professional, QC, supervisors, employees – depends on level of technical proficiency needed to perform said inspections), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures;

b. Any external inspections/certifications that may be required (e.g., asbestos accreditation).

8. ACCIDENT REPORTING. The Contractor shall identify person(s) responsible to provide the following:

   a. Exposure data (man-hours worked);

   b. Accident investigations, reports, and logs: Report all accidents as soon as possible but not more than 24 hours afterwards to the Baltimore County Public Schools Project Manager. The contractor shall thoroughly investigate the accident and submit the findings of the investigation along with appropriate corrective actions to the PM in the prescribed format as soon as possible but no later than five (5) working days following the accident. Implement corrective actions as soon as reasonably possible;

   c. The following require immediate accident notification:

      i. A fatal injury;

      ii. A permanent total disability;

      iii. A permanent partial disability;

      iv. The hospitalization of three or more people resulting from a single occurrence;

      v. Property damage of $200,000 or more.

9. PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. Plans may include but not be limited to:

   a. Layout plans;

   b. Emergency response plans:

      i. Procedures and tests;

      ii. Spill plans;

      iii. Firefighting plan;

      iv. Posting of emergency telephone numbers;

      v. Medical Support. Outline on-site medical support and off-site medical arrangements including rescue and medical duties for those employees who are to perform them, and the name(s) of on-site Contractor personnel trained in first aid and CPR. A minimum of two employees shall be certified in CPR and first-aid per shift/site;

c. Plan for prevention of alcohol and drug abuse;

d. Site sanitation plan;

e. Access and haul road plan;

f. Respiratory protection plan;

g. Health hazard control program;

h. Hazard communication program;

i. Not used;

j. Lead abatement plan;

k. Asbestos abatement plan;

l. Not used;

m. Abrasive blasting;

n. Heat/Cold Stress Monitoring Plan

o. Crystalline Silica Monitoring Plan (Assessment);

p. Not used;

q. Fire Prevention Plan;

r. Not used:

s. Hazardous energy control plan;

t. Critical lift Plan;

u. Contingency plan for severe weather;

v. Not used;

w. Site-Specific Fall Protection & Prevention Plan;

x. Demolition plan (to include engineering survey);

y. Confined Space Program.

10. RISK MANAGEMENT PROCESSES. Detailed project-specific hazards and controls shall be provided by an Activity Hazard Analysis for each major phase/activity of work.

B. Asbestos Hazard Abatement Plan Appendix: The AHAP shall include, but not be limited to, the following:

1. The personal protective equipment to be used;

2. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);

3. Initial exposure assessment in accordance with 29 CFR 1926.1101;

4. Level of supervision;

5. Method of notification of other employers at the worksite;

6. Abatement method to include containment and control procedures;

7. Interface of trades;

8. Sequencing of asbestos related work;

9. Storage and disposal procedures and plan;

10. Type of wetting agent and asbestos encapsulant;

11. Location of local exhaust equipment;

12. Air monitoring methods (personal, environmental and clearance);

13. Bulk sampling and analytical methods (if required);

14. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber;

15. Fire and medical emergency response procedures;

16. The security procedures to be used for all regulated areas.

C. Activity Hazard Analyses Appendix: AHAs for each major phase of work, shall be submitted and updated during the project. The AHAs format shall be in accordance with Figure 1-1 of EM 385-1-1. The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the AHA has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Baltimore County Public Schools representatives. The AHAs shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

D. Local Exhaust System: Local exhaust units shall conform to AIHA Z9.2 and 29 CFR 1926.1101. Filters on local exhaust system equipment shall conform to AIHA Z9.2 and UL 586. Filter shall be UL labeled. Submit pressure differential recordings and Manufacturer's certifications showing compliance with AIHA Z9.2 for:

1. Vacuums.

2. Water filtration equipment.

3. Ventilation equipment.

4. Other equipment required to contain airborne asbestos fibers.

1.8 SECURITY

Fenced and locked security area shall be provided for each regulated area. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the Baltimore County Public Schools PM. Personnel authorized to enter regulated areas shall be trained, medically evaluated, and wear the required personal protective equipment.

A. Licenses, Permits and Notifications: Obtain necessary licenses, permits and notifications in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Maryland Department of the Environment Air and Radiation Management Administration and Baltimore County Public Schools in writing, at least 10 days prior to the commencement of work, in accordance with 40 CFR 61, Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. Furnish copies of the receipts to the Baltimore County Public Schools PM, in writing, prior to the commencement of work. The Contractor is responsible for the associated fees/costs for licenses, permits, and notifications.

B. Regulated Areas: All Class I, and II asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

C. Warning Signs and Tape: Warning signs and tape printed in English shall be provided at the regulated boundaries and entrances to regulated areas. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs shall display the following legend:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

D. Warning Labels: Warning labels shall be affixed to all asbestos disposal containers, asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable.

1.9 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance requirements shall conform to 29 CFR 1926.1101. Asbestos workers shall be enrolled in a medical surveillance program that meets 29 CFR 1926.1101 (m) requirements and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. Submit required medical certification and the Physician's written opinion.

A. Respiratory Protection Program: The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926.1101 and 29 CFR 1910.134. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations.

B. Respiratory Fit Testing: The Contractor's Designated IH shall conduct a qualitative or quantitative fit test conforming to Appendix A of 29 CFR 1910.134 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test shall be performed. Functional fit checks shall be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

C. Respirator Selection and Use Requirements: Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators shall be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter shall be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

D. Personal Protective Equipment: Three complete sets of personal protective equipment shall be made available to the PM and authorized visitors for entry to the regulated area. The PM and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of personal protective equipment and the site safety and health requirements. Provide workers with personal protective clothing and equipment and ensure that it is worn properly. The Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment.

E. Whole Body Protection: Personnel exposed to or having the potential to be exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with 29 CFR 1926.1101. The Contractor's Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action

to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1. Coveralls: Disposable-impermeable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles.

2. Gloves: Gloves shall be provided to protect the hands where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.).

3. Foot Coverings: Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA, that is appropriate for safety and health hazards in the area shall be worn. Reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste.

4. Head Covering: Hood type disposable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

5. Protective Eye Wear: Eye protection shall be provided, when operations present a potential eye injury hazard, and shall meet the requirements of ANSI/ISEA Z87.1.

1.10 HYGIENE

Establish a decontamination area for the decontamination of employees, material and equipment. Ensure that employees enter and exit the regulated area through the decontamination area.

A. 3-Stage Decontamination Area: A temporary negative pressure decontamination unit that is adjacent and attached in a leak-tight manner to the regulated area shall be provided. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910.141, unless the Contractor can demonstrate that such facilities are not feasible. Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Lockers shall be provided for each asbestos worker in the clean room. Provide a minimum of 1 shower. Wastewater shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material. Filtered water shall be discharged to the sanitary sewer system. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste.

B. Load-Out Unit: A temporary load-out unit that is adjacent and connected to the regulated area shall be provided. The load-out unit shall be attached in a leak-tight manner to each regulated area.

C. Decontamination Area Exit Procedures: Ensure that the following procedures are followed:

1. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.

2. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal.

3. Employees shall not remove their respirators until showering.

4. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

D. Smoking: Smoking is prohibited on school property.

1.11 TRAINING PROGRAM

Establish and submit a training program as specified by EPA MAP, training requirements at 40 CFR 763, the Code of Maryland 26.11.23, OSHA requirements at 29 CFR 1926.1101 (k)(9). Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to Baltimore County Public Schools.

A. Class I and II operations 32 hours Asbestos Worker Training

Prior to commencement of work the Contractor's Designated IH and Competent Person shall instruct each worker about:

1. The hazards and health effects of the specific types of ACM to be abated; and

2. The content and requirements of the Contractor's APP to include the AHAP and AHAs and site-specific safety and health precautions.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent. Submit certificates stating that encapsulants meet the applicable specified performance requirements.

2.2 ENCASEMENT PRODUCTS

Encasement shall consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the PM.

2.3 EXPENDABLE SUPPLIES

A. Glovebag: Glovebags shall be provided as described in 29 CFR 1926.1101. The glovebag assembly shall be 0.15 mm 6 mil thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label. The Contractor is responsible for obtaining all variances required by Maryland for the use of glovebags.

B. Duct Tape: Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

C. Disposal Containers: Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926.1101. Disposal containers can be in the form of:
   1. Disposal Bags
   2. Fiberboard Drums
   3. Cardboard Boxes

D. Sheet Plastic: Sheet plastic shall be polyethylene of 0.15 mm 6 mil minimum thickness and shall be provided in the largest sheet size necessary to minimize seams. Film shall be clear and conform to ASTM D 4397, except as specified below:

   1. Flame Resistant: Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of NFPA 701.

   2. Reinforced: Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

E. Mastic Removing Solvent: Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 60 degrees C 140 degrees F.

F. Leak-tight Wrapping: Two layers of 0.15 mm 6 mil minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags as described in DETAIL SHEET 9B. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

G. Viewing Inspection Window: Where feasible, a minimum of 1 clear, 3 mm 1/8 inch thick, acrylic sheet, 450 by 610 mm 18 by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows shall be sealed leak-tight with industrial grade duct tape.

H. Wetting Agents: Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

I. Strippable Coating: Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work.

2.5 EQUIPMENT

A. Scales: Scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales shall be standard truck scales of the beam type; scales shall be equipped with the type registering beam and an "over and under" indicator; and shall be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Maryland. Scales shall be calibrated and resealed as often as necessary and at least once every three months to ensure continuous accuracy. Vehicles used for hauling ACM shall be weighed empty daily at such time as directed and each vehicle shall bear a plainly legible identification mark.

B. Tools: Vacuums shall be equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

C. Rental Equipment: If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment.

D. Air Monitoring Equipment: The Contractor's Designated IH shall approve air monitoring equipment. The equipment shall include, but shall not be limited to:

1. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.

2. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

3. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.

4. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH 94-113 Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).

5. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 20 to plus 60 degrees C minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work tasks shall be performed. Use the engineering controls and work practices required in 29 CFR 1926.1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment. Do not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. Personnel of other trades, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's APP are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910.147, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the Baltimore County Public Schools PM, including visual inspection and air sampling. Work shall resume only upon notification by the PM. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Perform asbestos abatement without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, it shall be restored to its original condition or decontaminated at no expense to Baltimore County Public Schools. When spills occur, work shall stop in all affected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the PM, work shall proceed.

3.3 OBJECTS

A. Removal of Mobile Objects: Preclean and remove mobile objects and equipment from the area of work before work begins. Furnishings shall be precleaned using HEPA filtered vacuum followed by wet wiping. These objects shall be removed to an area or site designated by Baltimore County Public Schools and stored.

B. Stationary Objects: Stationary objects and equipment shall remain in place and shall be precleaned using HEPA vacuum followed by adequate wet wiping. Stationary objects and furnishings shall be covered with 2 layers of polyethylene and edges sealed with duct tape.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

A. Building ventilation system supply and return air ducts in a regulated area shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910.147. The airtight seals shall consist of 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING

A. Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

3.6 METHODS OF COMPLIANCE

A. Mandated Practices: The specific abatement techniques and items identified shall be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

1. Vacuum cleaners equipped with HEPA filters.

2. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.

3. Prompt clean-up and disposal.

4. Inspection and repair of polyethylene.

5. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

B. Control Methods: Use the following control methods:

1. Local exhaust ventilation equipped with HEPA filter;

2. Enclosure or isolation of processes producing asbestos dust;

3. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and shall supplement them by the use of respiratory protection.

C. Unacceptable Practices: The following work practices shall not be used:

1. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

2. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

3. Dry sweeping, shoveling, or other dry clean up.

4. Employee rotation as a means of reducing employee exposure to asbestos.

D. Class I Work Procedures: In addition to requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

1. A Competent Person shall supervise the installation and operation of the control methods.

2. For jobs involving the removal of more than 7.5 m 25 feet or 0.9 square m 10 square feet of TSI or surfacing material, place critical barriers over all openings to the regulated area.

3. HVAC systems shall be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.

4. Impermeable drop cloths (0.15 mm 6 mil or greater thickness) shall be placed on surfaces beneath all removal activity.

5. The regulated area shall be ventilated with a HEPA unit and employees must use PPE.

E. Specific Control Methods for Class I Work

1. Negative Pressure Enclosure (NPE) System: The NPE system shall be established. The system shall provide at least 4 air changes per hour inside the containment. The local exhaust unit equipment shall be operated 24 hours per day until the containment is removed. The NPE shall be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.5 mm 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic manometric recording instrument and Records shall be provided daily on the same day collected to the PM. The PM shall be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system shall not be used as the local exhaust system for the regulated area. The NPE shall terminate outdoors unless an alternate arrangement is allowed by the PM. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

2. Glovebag Systems: Glovebags shall be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags shall be used only once and shall not be moved. Glovebags shall not be used on surfaces that have temperatures exceeding 66 degrees C 150 degrees F. Prior to disposal, glovebags shall be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least 2 persons shall perform glovebag removal. Asbestos regulated work areas shall be established for glovebag abatement. Designated boundary limits for the asbestos work shall be established with rope or other continuous barriers and all other requirements for asbestos control areas shall be maintained, including area signage and boundary warning tape.

    a. Attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.

    b. The negative pressure glove boxes shall be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure shall be created in the system using a HEPA filtration system. The box shall be smoke tested for leaks prior to each use.

3. Mini-Enclosures: Mini-containment (small walk-in enclosure) to accommodate no more than 2 persons, may be used if the disturbance or removal can be completely contained by the enclosure. The mini-enclosure shall be inspected for leaks and smoke tested before each use. Air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

4. Wrap and Cut Operation: Wrap and cut operations may be used if pipe systems are being demolished and with permission from the Baltimore County Public Schools. Prior to cutting pipe, the asbestos-containing insulation shall be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps shall be taken: install glovebag, strip back sections to be cut 150 mm 6 inches from point of cut, and cut pipe into manageable sections.

F. Class II Work: In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

1. A Competent Person shall supervise the work.

2. For indoor work, critical barriers shall be placed over all openings to the regulated area.

3. Impermeable drop cloths shall be placed on surfaces beneath all removal activity.

G. Specific Control Methods for Class II Work

1. Vinyl and Asphalt Flooring Materials: Resilient sheeting shall be removed by adequately wet methods. Tiles shall be removed intact (if possible); wetting is not required when tiles are heated and removed intact. Flooring or its backing shall not be sanded. Scraping of residual adhesive and/or backing shall be performed using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors.

2. Transite Panels: Intentionally cutting, abrading or breaking is prohibited. Each panel shall be sprayed with amended water prior to removal. Nails shall be cut with flat, sharp instruments. Unwrapped or unbagged panels or shingles shall be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift.

3. Gaskets: Gaskets shall be thoroughly wetted with amended water prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal shall be undertaken within a glovebag. Any scraping to remove residue shall be performed wet.

3.7 FINAL CLEANING AND VISUAL INSPECTION

After completion of all asbestos removal work and the gross amounts of asbestos have been removed from every surface, any remaining visible accumulations of asbestos shall be collected. For all classes of indoor asbestos abatement projects a final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring. The Contractor and the PM shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection. If the PM rejects the clean regulated area as not meeting final cleaning requirements, reclean as necessary and have a follow-on inspection conducted with the PM. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after final visual inspection, a (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 EXPOSURE ASSESSMENT AND AIR MONITORING

A. General Requirements

1. Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101, and the Contractor's air monitoring plan. Results of breathing zone samples shall be posted at the job site and made available to the PM. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

2. Worker Exposure.

a. The Contractor's Designated IH shall collect samples representative of the exposure of each employee who is assigned to work within a regulated area. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section.

b. Provide an onsite independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926.1101, to include NIOSH 94-113 Method 7400.

c. Workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, stop work immediately, notify the Baltimore County Public Schools Project Manager and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Do not restart work until authorized by the PM.

3. Environmental Exposure

a. All environmental air monitoring shall be performed by the Contractor's Designated IH.

b. Environmental and final clearance air monitoring shall be performed using NIOSH 94-113 Method 7400 (PCM) with confirmation of results by TEM.

c. For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc.

d. When confirming asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples, use TEM in accordance with NIOSH 94-113 Method

7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH 94-113 Method 7400 PCM analysis. All confirmation of asbestos fiber concentrations, using NIOSH 94-113 Method 7402, shall be at the Contractor's expense.

e. Monitoring may be duplicated by Baltimore County Public Schools at the discretion of the PM and at the Baltimore County Public Schools expense.

f. Maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement.

g. At the discretion of the Baltimore County Public Schools PM, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. Should an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA occur inside a regulated work area, stop work immediately, notify the Baltimore County Public Schools PM, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the PM.

B. Initial Exposure Assessment: The Contractor's Designated IH shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements, which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of PELs, or otherwise makes a negative exposure assessment, presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

C. Negative Exposure Assessment: Provide a negative exposure assessment for the specific asbestos job which will be performed within 10 days of the initiation of the project and conform to the following criteria:

1. Objective Data: Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the PEL-TWA and PEL-Excursion Limit under those work conditions having the greatest potential for releasing asbestos.

2. Prior Asbestos Jobs: Where the Contractor has monitored prior asbestos jobs for the PEL and the PEL-Excursion Limit within 12 months of the current job, the monitoring and analysis were performed in compliance with asbestos standard in effect; the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by employees whose training and experience are no more

extensive than that of employees performing the current job; and these data show that under the conditions prevailing and which will prevail in the current workplace, there is a high degree of certainty that the monitoring covered exposure from employee exposures will not exceed the PEL-TWA and PEL-Excursion Limit.

3. Initial Exposure Monitoring: The results of initial exposure monitoring of the current job, made from breathing zone air samples that are representative of the 8-hour PEL-TWA and 30-minute short-term exposures of each employee. The monitoring covered exposure from operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

D. Independent Environmental Monitoring: The air monitoring Contractor has been provided a copy of the contract that includes this abatement work. The abatement Contractor will provide the air monitoring Contractor with an up-to-date copy of the accepted AHAP, APP and pertinent detailed drawings. The air monitoring Contractor is required to comply with the abatement Contractor's safety and health requirements. The abatement Contractor will coordinate all onsite activities with the air monitoring Contractor, the PM, and other affected parties as directed by the PM. The abatement Contractor will provide the air monitoring Contractor with an up-to-date schedule of abatement Contractor work activities. The air monitoring Contractor will coordinate with the abatement Contractor and the PM during the performance of Baltimore County Public Schools required air monitoring. The abatement Contractor is responsible for performing exposure assessment and personal air monitoring of abatement Contractor's work. The air monitoring Contractor is responsible for performing these tasks for its employee.

E. Preabatement Environmental Air Monitoring: Preabatement environmental air monitoring shall be established 1 day prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH 94-113 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. One sample shall be collected for every 185 square meters 2000 square feet of floor space. At least 2 samples shall be collected outside the building: at the exhaust of the HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH 94-113 Method 7402 (TEM).

F. Environmental Air Monitoring During Abatement: Until an exposure assessment is provided to the PM, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside a regulated area; preabatement sampling locations; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the PM notified. The

condition causing the increase shall be corrected. Work shall not restart until authorized by the PM.

G. Final Clearance Air Monitoring: The Contractor's Designated IH shall conduct final clearance air monitoring using aggressive air sampling techniques as defined in 40 CFR 763, Subpart E, Appendix A, Unit III, TEM Method B.7(d-f) and Table 4 of this section for all indoor asbestos abatement projects.

1. Final Clearance Requirements, EPA TEM Method: For EPA TEM sampling and analysis, using the EPA Method specified in 40 CFR 763, abatement inside the regulated area is considered complete when the arithmetic mean asbestos concentration of the 5 inside samples is less than or equal to 70 structures per square millimeter (70 S/mm). When the arithmetic mean is greater than 70 S/mm, the 3 blank samples shall be analyzed. If the 3 blank samples are greater than 70 S/mm, resampling shall be done. If less than 70 S/mm, the 5 outside samples shall be analyzed and a Z-test analysis performed. When the Z-test results are less than 1.65, the decontamination shall be considered complete. If the Z-test results are more than 1.65, the abatement is incomplete and cleaning shall be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

2. Air Clearance Failure: If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

H. Air-Monitoring Results and Documentation: Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 24 hours (environmental/clearance monitoring) after completion of a sampling period. The PM shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's Designated IH. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

1. Sampling and analytical method used;

2. Date sample collected;

3. Sample number;

4. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental, C = Abatement Clearance;

5. Location/activity/name where sample collected;

6. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);

7. Calibration date, time, method, location, name of calibrator, signature;

8. Sample period (start time, stop time, elapsed time (minutes);

9. Total air volume sampled (liters);

10. Sample results (f/cc and S/mm square) if EPA methods are required for final clearance;

11. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the PM will allow the warning signs and boundary warning tape to be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of such filters as asbestos contaminated materials. HVAC, mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the PM shall visually inspect all surfaces within the containment for residual material or accumulated debris. Reclean all areas showing dust or residual materials. The PM will certify in writing that the area is safe before unrestricted entry is permitted. Baltimore County Public Schools will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.11 CLEANUP AND DISPOSAL

A. Title to ACM Materials: ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

B. Collection and Disposal of Asbestos: All ACM waste shall be collected including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing and placed in leak-tight containers. Waste within the containers shall be wetted in case the container is breeched. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the PM. Procedure for hauling and disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards. Submit manufacturer's catalog data for all materials and equipment to be used, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Material Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

1. High Efficiency Filtered Air (HEPA) local exhaust equipment

2. Vacuum cleaning equipment

3. Pressure differential monitor for HEPA local exhaust equipment

4. Air monitoring equipment

5. Respirators

6. Personal protective clothing and equipment

7. Glovebags. Written manufacturer's proof that glovebags will not break down under expected temperatures and conditions.

8. Duct Tape

9. Disposal Containers

10. Sheet Plastic

11. Wetting Agent

12. Strippable Coating

13. Prefabricated Decontamination Unit

14. Material Safety Data Sheets (for all chemicals proposed)

C. Records and Management Plan

1. Asbestos Waste Shipment Records: Complete and provide the PM final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the Contractor, the waste transporter and disposal facility operator.

2. Asbestos Management Plan: Provide a summary, in electronic form, of site activities (bulk samples, asbestos removed, repaired, encased, etc.) for updating the school’s Asbestos Management Plan.

Note: Table 1 has been removed.

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL

(Reference: NIOSH 7400)

Fibers/cc(01.95 percent CL) = X + [(X) * (1.645) * (CV)]

Where: X = ((E)(AC))/((V)(1000))

E = ((F/Nf) - (B/Nb))/Af

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the PM with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

TWA = C1/T1 + C2/T2 = Cn/Tn

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3

NIOSH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (LPM)
Inside Abatement Area	0.5/140 m^2 (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 m2		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.

3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).

4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 4

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Liters)	Sampling Rate (LPM)
Inside Abatement Area	5	0.45 microns	1200	2-16
Outside Abatement Area	5	0.45 microns	1200	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____

PROJECT ADDRESS _____

CONTRACTOR FIRM NAME _____

EMPLOYEE'S NAME _____,_____,_____,

(Print) (Last) (First) (MI)

Social Security Number: _____-_____-_____,__(Optional)

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

_____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:

_____ (1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

(3) For OSHA Class II work (there will only be abatement of one type of Class II material):

_____ (a) I have completed an 8-hour training class on the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926.1101(g) and hands-on training.

_____ (b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

_____ (4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101, and hands-on training.

_____ (5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101(g) and hands-on training.

_____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:

_____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:

_____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:

_____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

EPA/MARYLAND CERTIFICATION/LICENSE

I have an EPA/Maryland certification/license as:

Building Inspector/Management Planner; Certification #_____

Contractor/Supervisor, Certification # _____

Project Designer, Certification # _____

Worker, Certification # _____

MEDICAL EXAMINATION:

_____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were no limitations to performing the required work tasks.

_____ were identified physical limitations to performing the required work tasks.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

Date of the medical examination _____

Employee Signature _____ date _____

Contractor's Industrial

Hygienist Signature _____ date _____

-- End of Section --

SECTION 028313 - LEAD IN CONSTRUCTION

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

2. HUD 6780 (1995; Errata Aug 1996;Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

3. 29 CFR 1926.103 Respiratory Protection

4. 29 CFR 1926.21 Safety Training and Education

5. 29 CFR 1926.33 Access to Employee Exposure and Medical Records

6. 29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists

7. 29 CFR 1926.59 Hazard Communication

8. 29 CFR 1926.62 Lead

9. 29 CFR 1926.65 Hazardous Waste Operations and Emergency Response

10. 40 CFR 260 Hazardous Waste Management System: General

11. 40 CFR 261 Identification and Listing of Hazardous Waste

12. 40 CFR 262 Standards Applicable to Generators of Hazardous Waste

13. 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

14. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

15. 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

16. 40 CFR 268 Land Disposal Restrictions

17. 40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures

18. 49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

19. 49 CFR 178 Specifications for Packagings

20. UL 586 (2009; Reprint Sep 2014) Standard for High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period.

B. Area Sampling: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

C. Competent Person (CP): As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

D. Contaminated Room: Refers to a room for removal of contaminated personal protective equipment (PPE).

E. Decontamination Shower Facility: That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

F. High Efficiency Particulate Arrestor (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

G. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

H. Lead Control Area: A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

I. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:

PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

J. Material Containing Lead/Paint with Lead (MCL/PWL): Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

K. Personal Sampling: Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

L. Physical Boundary: Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

A. Description of Work: Lead –based paint is assumed to be in the building.

B. Coordination with Other Work: The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 013300 SUBMITTAL PROCEDURES:

1. Preconstruction Submittals
   a. Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment)
   b. Lead Compliance Plan including CP approval (signature, date, and certification number)
   c. Competent Person qualifications
   d. Training Certification of workers and supervisors
   e. Lead waste management plan
   f. Written evidence that TSD is approved for lead disposal
   g. Certification of Medical Examinations

2. Test Reports

   a. Sampling results

   b. Occupational and Environmental Assessment Data Report

3. Certificates

a. Testing laboratory qualifications

b. Third party consultant qualifications

c. Clearance Certification

4. Closeout Submittals

a. Completed and signed hazardous waste manifest from treatment or disposal facility

b. Waste turn-in documents or weight tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition landfills

1.5 QUALITY ASSURANCE

A. Qualifications

1. Competent Person (CP): Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and licensed in accordance with federal, State and local laws. The competent person shall be a licensed lead-based paint abatement Supervisor/Project Designer in the State of Maryland.

2. Training Certification: Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(l)and is certified to perform or supervise deleading, lead removal or demolition activities in the State of Maryland.

3. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

4. Third Party Consultant Qualifications: Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

B. Requirements

1. Competent Person (CP) Responsibilities

   a. Verify training meets all federal, State, and local requirements.

   b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.

   c. Continuously inspect PWL or MCL work for conformance with the approved plan.

   d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

   e. Ensure work is performed in strict accordance with specifications at all times.

   f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

   g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.

   h. Certify the conditions of the work as called for elsewhere in this specification.

2. Lead Compliance Plan: Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures. In occupied buildings, the plan shall also include an occupant protection program that describes the measures that will be taken during the work to protect the building occupants.

3. Occupational and Environmental Assessment Data Report: If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the

CP. In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

4. Medical Examinations: Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

5. Training: Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.

6. Respiratory Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.

b. Establish and implement a respiratory protection program as required by AIHA Z88.6, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

7. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29CFR 1926.59.

8. Lead Waste Management: The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations. and address:

a. Identification and classification of wastes associated with the work.

b. Estimated quantities of wastes to be generated and disposed of.

c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA hazardous waste manifests and USEPA Identification numbers.

d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

e. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.

f. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.

g. Include any process that may alter or treat waste rendering a hazardous waste non-hazardous.

h. Unit cost for hazardous waste disposal according to this plan.

9. Environmental, Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply. The following State laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:

   a. COMAR

   b. Licensing and certification in the State of Maryland is required.

C. Pre-Construction Conference

1. Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

A. Respirators: Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

B. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

C. Rental Equipment Notification: If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

D. Vacuum Filters: UL 586 labeled HEPA filters.

E. Equipment for Contracting Officer: Furnish the with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor.

1.7 PROJECT/SITE CONDITIONS

A. Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protection

1. Notification

   a. Notify the Contracting Officer 10 days prior to the start of any lead work.

2. Lead Control Area

a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.

b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3. Furnishings

a. Facilities will remove furniture and equipment from the building before lead work begins.

4. Heating, Ventilating and Air Conditioning (HVAC) Systems

a. Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

5. Decontamination Shower Facility

a. Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

6. Eye Wash Station

a. Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

7. Mechanical Ventilation System

a. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.

b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.

c. Use locally exhausted, power actuated tools or manual hand tools.

8. Personnel Protection

a. Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

A. Lead Control Area Requirements

1. Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

3.3 APPLICATION

A. Lead Work: Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 or 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

B. Paint with Lead or Material Containing Lead Removal: Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

1. Paint with Lead or Material Containing Lead - Indoor Removal: Perform manual or mechanical removal in the lead control areas using enclosures, barriers or containments and powered locally exhausted tools. Collect residue debris for disposal in accordance with federal, State, and local requirements.

2. Paint with Lead or Material Containing Lead - Outdoor Removal: Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) shall be job dependent and presented in the Lead Compliance Plan.

3. Personnel Exiting Procedures: Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

a. Vacuum all clothing before entering the contaminated change room.

b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.

c. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.

d. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

A. Tests

1. Air and Wipe Sampling: Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.

   a. The CP shall be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.

   b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

   c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.

   d. Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.

B. Sampling After Removal: After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust in micrograms per square meter foot of surface area.

3.5 CLEANING AND DISPOSAL

A. Cleanup: Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.

1. Clearance Certification: The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not

remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification. The third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 40 micrograms per square foot on floors, less than 250 micrograms per square foot on interior window sills and less than 400 micrograms per square foot on window troughs.

2. Disposal

a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.

c. Dispose of lead-contaminated material classified as hazardous waste at an EPA approved hazardous waste treatment, storage, or disposal facility off Baltimore County property.

d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.

e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

3. Disposal Documentation: Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

4. Payment for Hazardous Waste: Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to Baltimore County.

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SECTION 028416 - HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. COMAR 26.13 (1988) Chapters .01- .13, Disposal of Controlled Hazardous Substances
2. 29 CFR 1910.1000 Air Contaminants
3. 40 CFR 260 Hazardous Waste Management System: General
4. 40 CFR 261 Identification and Listing of Hazardous Waste
5. 40 CFR 262 Standards Applicable to Generators of Hazardous Waste
6. 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste
7. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
8. 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
9. 40 CFR 268 Land Disposal Restrictions
10. 40 CFR 270 EPA Administered Permit Programs: The Hazardous Waste Permit Program
11. 40 CFR 273 Standards For Universal Waste Management
12. 40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
13. 49 CFR 178 Specifications for Packagings

1.2 REQUIREMENTS

A. Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

B. Inspect fluorescent lamp ballasts for a “no PCBs” label. Dispose of any that DO NOT have this label as PCB-containing waste.

C. Remove and dispose of fluorescent lamps, compact fluorescent bulbs and incandescent bulbs as universal waste.

1.3 DEFINITIONS

A. Certified Industrial Hygienist (CIH) - An industrial hygienist hired by the contractor shall be certified by the American Board of Industrial Hygiene.

B. Leak - Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

C. Lamps - Lamp, also referred to as "universal waste lamp", is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

D. Polychlorinated Biphenyls (PCBs) - PCBs as used in this specification shall mean the same as PCBs, PCB containing lighting ballast, and PCB container, as defined in 40 CFR 761, Section 3, Definitions.

E. Spill - Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

F. Universal Waste - Universal Waste means any of the following hazardous wastes that are managed under the universal waste requirements 40 CFR 273

1. Batteries as described in Sec. 273.2 of this chapter

2. Pesticides as described in Sec. 273.3 of this chapter

3. Thermostats as described in Sec. 273.4 of this chapter

4. Lamps as described in Sec. 273.5 of this chapter.

1.4 QUALITY ASSURANCE

A. Perform PCB related work in accordance with 40 CFR 761 and COMAR 26.13. Perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, 40 CFR 273 and COMAR 26.13.

B. Certified industrial hygienist (CIH) shall instruct and certify the training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices,

and applicable OSHA and EPA regulations. The CIH shall review and approve the PCB and Mercury-Containing Lamp Removal Work Plans.

C. Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, 40 CFR 273 and COMAR 26.13 and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Certificates

   a. Qualifications of CIH

   b. Training Certification

   c. PCB and Lamp Removal Work Plan

   d. PCB and Lamp Disposal Plan

2. Closeout Submittals

   a. Transporter certification of notification to EPA of their PCB waste activities and EPA ID numbers

   b. Certification of Decontamination

   c. Certificate of Disposal and/or recycling. Submit to the Owner's Representative before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Use special clothing:

1. Disposable gloves (polyethylene)

2. Eye protection

3. PPE as required by CIH

1.7 SCHEDULING

A. Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

1.8 QUALITY ASSURANCE

A. Qualifications of CIH: Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph entitled "Certified Industrial Hygienist." Submit training certification that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

B. PCB and Lamp Removal Work Plan: Submit a job-specific plan within 10 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work

C. PCB and Lamp Disposal Plan: Submit a PCB and lamp Disposal Plan with 45 calendar days after award of contract. The PCB and Lamp Disposal Plan shall comply with applicable requirements of federal, state, and local PCB and Universal waste regulations and address:

1. Estimated quantities of wastes to be generated, disposed of, and recycled.

2. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.

3. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.

4. Spill prevention, containment, and cleanup contingency measures to be implemented.

5. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize daily.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 WORK PROCEDURE

A. Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

1. Work Operations: Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

a) Obtaining suitable PCB and mercury-containing lamp storage sites.

b) Notifying Contracting Officer prior to commencing the operation.

c) Reporting leaks and spills to the Contracting Officer.

d) Cleaning up spills.

e) Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

f) Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

A. PCB Spills: Immediately report to the Contracting Officer any PCB spills.

B. PCB Spill Control Area: Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

C. PCB Spill Cleanup: 40 CFR 761, subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste.

D. Records and Certification: Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

3.3 REMOVAL

A. Ballasts: As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label shall be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts dispose of them as normal demolition debris. If there are more than 1600 "No PCB" labeled ballasts, establish whether the "No PCB" labeled ballasts contain diethylhexyl phthalate (DEHP) either by test or by checking with the ballast manufacturer indicated on the label. Submit testing results and/or written confirmation from the manufacturer to the Contracting Officer. If the ballasts do not contain DEHP, dispose of them as normal construction debris. If they do contain DEHP, dispose of them as hazardous material in accordance with Federal, State, and local regulations. As a basis of bid assume ballasts with "No PCB" labels do not contain DEHP and may disposed of as normal construction debris. If 1600 or more DEHP ballasts are disposed of in a 24 hour period, notify the National Response Team at 800-424-8802.

B. Lighting Lamps: Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

3.4 STORAGE FOR DISPOSAL

A. Storage Containers for PCBs: 49 CFR 178. Store PCB in containers approved by DOT for PCB.

B. Storage Containers for lamps: Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

C. Labeling of Waste Containers:

1. Date the item was placed in storage and the name of the cognizant activity/building.

2. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.

3. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

3.5 DISPOSAL

A. Dispose of off property in accordance with EPA, DOT, and local regulations at a permitted site.

B. Identification Number: Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste possess U.S. EPA identification numbers. The contractor shall verify that the activity has a U.S. EPA generator

identification number for use on the Uniform Hazardous Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work. For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUW) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

C. Transporter Certification: Comply with disposal and transportation requirements outlined in 40 CFR 761 and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Owner's Representative. Return a signed copy to the Owner's Representative before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

1. 40 CFR 761. Certificate for the PCBs and PCB items disposed shall include:

   a) The identity of the disposal and or recycling facility, by name, address, and EPA identification number.

   b) The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.

   c) A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.

   d) A certification as defined in 40 CFR 761.

END OF DOCUMENT 028416

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SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 REFERENCE STANDARDS

A. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute.

B. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

C. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

D. ACI 347 – Guide to Formwork for Concrete; American Concrete Institute.

E. ASME A17.1 – Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers.

1.3 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing and arrangement of joints and ties.

1. Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings shall be signed and sealed by an engineer registered in the local jurisdiction.
2. Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
3. Indicate location of all slab joint types.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

1. Maintain one copy of standards on project site.

PART 2 - PRODUCTS

2.1 FORMWORK – GENERAL

A. Provide concrete forms, accessories, shoring and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301 and ACI 318.

2.2 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.3 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.

C. Corners: Chamfered, rigid plastic or wood strip type, ¾ x ¾ inch size, maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Waterstops: Preformed mineral colloid strips, ¾ inch thick, moisture expanding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION – FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Provide chamfer strips on external corners of beams, joists, and columns.

D. Install void forms in accordance with manufacturer’s recommendations. Protect forms from moisture or crushing.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.4 APPLICATION – FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer’s recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS AND OPENINGS

A. Provide formed openings where required for items to be embedded or passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
2. During cold weather, remove ice and snow from within forms. Do not use deicing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless more stringent tolerances are required within the contract documents.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

B. Inspect erected formwork, shoring and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION – 031000

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SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

C. ACI SP-66 – ACI Detailing Manual; American Concrete Institute.

D. ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

E. ASTM A 1064/A 1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain, Deformed, for Concrete.

F. CRSI (DA4) – Manual of Standard Practice; Concrete Reinforcing Steel Institute.

G. CRSI (P1) – Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.3 SUBMITTALS

A. See Section 013000: Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer’s Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, ACI SP-66, and ACI 318.

1. Maintain one copy of each document on the project site.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).

1. Deformed billet-steel bars.
2. Unfinished.

B. Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain type.

1. Flat sheets.
2. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Supports and Spacers in Contact with the Ground:

    a. Precast concrete supports with a surface area of not less than 4 in^2, a compressive strength equal to or greater than the specified compressive strength of the concrete being placed, and embedded tie wires for securing the reinforcement.
    b. Chairs with plastic components and sand plates.
    c. Spacers: Plastic.

4. Provide stainless steel components for placement within 1½ inches of weathering surfaces.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) – Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

1. Review location of splices with Architect.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement before and during concrete placement. Do not deviate from required position.

B. Clean reinforcement of loose rust, mill scale, earth, ice and other foreign materials that would reduce bond to concrete.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Conform to structural drawings for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

A. An independent inspection agency, as specified in Section 014000, will inspect installed reinforcement for conformance to contract documents before placing concrete. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

END OF SECTION 032000

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Floors and slabs on grade.

B. Footings.

C. Piers.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads.

1.2 RELATED REQUIREMENTS

A. Section 031000 – Concrete Forming and Accessories.

B. Section 032000 – Concrete Reinforcing.

C. Section 033900 – Concrete Curing.

D. Section 079513 – Expansion Joint Cover Assemblies.

E. Section 079005 – Joint Sealers.

1.3 REFERENCE STANDARDS

A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute.

C. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

D. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

E. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.

F. ACI 305R – Hot Weather Concreting; American Concrete Institute.

G. ACI 306R – Cold Weather Concreting: American Concrete Institute.

H. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.

I. ASTM C 33 – Standard Specification for Concrete Aggregates.

J. ASTM C 39/C 39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

K. ASTM C 94/C 94M – Standard Specification for Ready-Mixed Concrete.

L. ASTM C 150 – Standard Specification for Portland Cement.

M. ASTM C 173/C 173M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

N. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.

O. ASTM C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete.

P. ASTM C 494/ C 494M – Standard Specification for Chemical Admixtures for Concrete.

Q. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

R. ASTM C 881/C 881M – Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete.

S. ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

T. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

U. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

V. ASTM C 1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.

W. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).

X. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.

Y. ASTM E 329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.

Z. IBC 2018 – International Building Code.

1.4 SUBMITTALS

A. See Section 013000 – Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's data on manufactured products showing compliance with specified requirements.

C. Samples: Submit samples of under-slab vapor retarder to be used.

D. Design Mixtures:

1. Submit for each concrete mixture.
2. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
3. Indicate amounts of mixing water to be withheld for later addition at project site.

1.5 QUALITY ASSURANCE

A. Concrete Producer: Engage a firm with experience in producing concrete similar to that indicated for this project with a record of successful in-service performance as well as sufficient production capacity to supply concrete without delaying the work.

1. Provide documentation that concrete producer has supplied concrete for at least 3 projects of similar complexity in the last six years.

B. Concrete Contractor: Engage a firm with experience in placing and finishing concrete similar to that indicated for this project with a record of successful in-service performance.

1. Provide documentation that the concrete contractor has installed concrete for at least 3 projects of similar complexity in the last six years.

C. Perform work of this section in accordance with ACI 301 and ACI 318.

1. Maintain one copy of each document on site.

D. Follow recommendations of ACI 305R when concreting during hot weather.

E. Follow recommendations of ACI 306R when concreting during cold weather.

F. All form release agents and membrane curing compounds used for slabs and walls that are to be waterproofed shall be submitted to the manufacturer of hot fluid waterproofing system for compatibility review prior to application.

G. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1.
2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 031000.

2.2 REINFORCEMENT

A. Comply with requirements of Section 032000.

2.3 CONCRETE MATERIALS

A. Cement – ASTM C 150 Type 1 – Normal Portland type.

1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.

1. Acquire all aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C 330.

D. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

E. Fly Ash: ASTM C 618 Class F.

F. Calcined Pozzolan: ASTM C 618 Class N.

G. Silica Fume: ASTM C 1240.

H. Water: Clean and not detrimental to concrete.

I. Regional Materials: Provide cement and aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

2.4 CHEMICAL ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C 260.

C. High Range Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

D. High Range Water Reducing Admixture: ASTM C 494/C 494M, Type F.

E. Water Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

F. Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

G. Accelerating Admixture: ASTM C 494/C 494M, Type C.

H. Retarding Admixture: ASTM C 494/C 494M, Type B.

I. Water Reducing Admixture: ASTM C 494/C 494M, Type A.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Barrier / Vapor Retarder: Comply with ASTM E 1745, Class A.

1. Maximum Permeance ASTM E 96: 0.018 perms (English).
2. Provide standard accessories and tape for complete system.
3. Acceptable Products:

    a. Stego Wrap (15-mil) Vapor Barrier by Stego Industries LLC.
    b. Perminator: 15 mils by W.R. Meadows, Inc.
    c. 15 Mil Green by Reef Industries, Inc.
    d. Vapor Block 15 by Raven Industries.
    e. Yellow Guard 15-mil Vapor Barrier by Poly-America.

4. Single ply polyethylene is prohibited.

B. Non-Shrink Grout: ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,400 psi.
2. Minimum Compressive Strength at 28 Days: 7,000 psi.

C. Curing Materials: Comply with requirements of Section 033900.

2.6 BONDING AND JOINTING PRODUCTS

A. Bonding Agent: Epoxy bonding system complying with ASTM C 881/C 881M and of Type required for specific application.

B. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.

1. Manufacturers:

    a. Aquafin, Inc.: www.aquafin.net.
    b. Xypex Chemical Corporation: www.xypen.com.
    c. Kryton International Inc: www.kryton.com.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophilic material for adhesive bonding to concrete.

1. Available Products:

    a. Volclay Waterstop-RX: Colloid Environmental Technologies Co.
    b. Conseal CS-231: Concrete Sealants Inc.
    c. Swellseal Joint: De Neef Construction Chemicals (U.S.) Inc.
    d. Hydrotite: Greenstreak.
    e. Mirastop: Mirafil Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
    f. Adeka Ultra Seal: Mitsubishi International Corporation.
    g. Superstop: Progress Unlimited Inc.

D. Joint Filler: Non-extruding, resilient asphalt impregnated fiberboard, cork or flexible foam, complying with ASTM D 1751, thickness as indicated on drawings and full depth of slab less ½ inch; tongue and groove profile.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum1 inch diameter holes for conduit or rebars to pass through at 6 inches on center, ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
2. Height: To suit slab thickness.

F. Sealant and Primer: As specified in Section 079005.

2.7 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

1. Replace no less than 30% and no more than 50% of Portland cement in structural concrete with approved pozzolanic materials.
2. Ground Granulated Blast Furnace Slag Content: Not to exceed 50% of cementitious material by weight.
3. Fly Ash or Calcined Pozzolan Content: Not to exceed 25% of cementitious material by weight.
4. Silica Fume Content: Not to exceed 10% of total cementitious material by weight.
5. Obtain approval in advance before submitting mix containing any other pozzolanic substances.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on drawings.

2. Water-Cementitious Materials Ratio: Maximum 58% by weight. Maximum 40% by weight for exterior concrete.

    a. Interior slabs shall have a maximum water-cementitious material ratio of 50% by weight.

3. Entrained air content for trowel-finished interior slabs shall not exceed 3%, determined in accordance with ASTM C 173/C 173M.
4. Entrained air content for footings shall not exceed 4.5%, determined in accordance with ASTM C 173/C 173M
5. Air Content for Exterior Exposed Concrete: Add air entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus 1 or minus 1.5%, unless otherwise indicated.

    a. Air Content: 6% entrained air, determined in accordance with ASTM C 173/C 173M.

6. Maximum Slump: 4 inches.
7. Maximum Aggregate Size: 1 inch.

2.8 MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.

B. Do not add water to concrete during delivery, at the project site or during placement except as predetermined by concrete mix, unless approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent, as indicated on the drawings, in accordance with the manufacturer's instructions.

B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete and insert steel dowels using an epoxy adhesive approved by the Architect.

D. Install vapor retarder under interior slabs on grade in accordance with manufacturer's instructions and ASTM E 1643.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Separate slabs on grade from vertical surfaces with joint filler.

E. Place joint filler in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

F. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 079005 for finish joint sealer requirements.

G. Install joint devices in accordance with manufacturer's instructions.

H. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Install joint device anchors for expansion joint assemblies specified in Section 079513. Maintain correct position to allow joint cover to be flush with floor and wall finish.

J. Apply sealants in joint devices in accordance with Section 079005.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

L. Place concrete continuously between predetermined expansion, control and construction joints.

M. Do not interrupt successive placement. Do not permit cold joints to occur.

N. Place slabs on grade with saw cut pattern indicated.

O. Saw cut joints as soon as the concrete is firm enough not to be damaged by the cutting action. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

3.4 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas ¼ inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas ¼ inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of Section 033513.

3.5 CURING AND PROTECTION

A. Comply with requirements of Section 033900.

3.6 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000. Inspection services shall conform to Section 1705.3 and Table 1705.3 of the 2018 IBC Code and the Statement of Special Inspections noted in the structural drawings. The exceptions noted in Section 1705.3 shall not be allowed.

B. Provide free access to concrete operations at project site and cooperate with appointed firm; inspection to occur for:

1. Steel reinforcement placement.
2. Anchor bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Test composite samples of fresh concrete obtained according to ASTM C 172.

F. Compressive Strength Tests: ASTM C 39/C 39M.

1. Compression Test Specimens: ASTM C31/C 31M; cast and laboratory cure five 6”x12” standard cylinder specimens or seven 4”x8” standard cylinder specimens for each composite sample.
2. Test one laboratory-cured specimen at 7 days and one set of two 6”x12” or three 4”x8” specimens at 28 days. Remaining cylinders shall be held in reserve.
3. Obtain test samples for every 75 cu.yd. or less of each class of concrete placed each day.
4. A compressive-strength test shall be the average compressive strength from all specimens obtained from same composite sample and tested at age indicated.
5. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

G. Perform one slump test, at point of discharge for each set of test cylinders taken, following procedures of ASTM C 143/C 143M.

H. Perform air content test for each set of test cylinders taken, following procedures of ASTM C 231.

I. Perform unit weight test of structural lightweight concrete for each set of test cylinders taken, following procedures of ASTM C 567.

J. Test concrete temperature each hour when air temperature is 40 degrees F and below and when 80 degrees F and above, and for each set of test cylinders taken, following procedures of ASTM C 1064/C 1064M.

3.7 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to the Architect and Contractor within 24 hours of test.

1. Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by the Architect.
2. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Architect.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies that test reports and inspections indicate do not comply with specified requirements.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements. Repair or replace defective concrete, subject to the approval of the Architect.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of the Architect for each individual area.

END OF SECTION - 033000

SECTION 033301 – ARCHITECTURAL CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural Cast-in-Place Architectural Concrete as shown on the drawings and/or as specified herein. Work generally includes but is not limited to cast-in-place exposed to view concrete:

    a. All wall and vertical concrete surfaces as shown in the Landscape Plans.
    b. Planter walls, seat walls, benches with concrete bases, exposed curbs and fixture and light foundations, stairs, etc.

2. This section specifies requirements for Cast-in-Place Architectural Concrete work, including concrete materials, mix design, formwork, reinforcement, placement and finishing procedures and other items required in producing of the work. This Section is to be used jointly with the Cast-in-Place Architectural Concrete Section. Where an item is not included in this section, the requirements of the Cast-in-Place Architectural Concrete Section shall apply.

1.3 RELATED SECTIONS

A. This section includes additional requirements for and relating to the following sections:

1. Section 129300 “Site Furnishings” for elements to be located on architectural cast-in-place concrete.

1.4 SUBMITTALS

A. Qualification Data: Submit qualifications for Cast-in-Place Architectural Concrete contractor. Submit completed projects, including name, description of responsibilities, scope of work, and references.

B. Product Data: As applicable, submit manufacturer’s name and technical information for each of the following products listed below:

1. Design mixtures, material certificates, and material test reports; for each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
2. Form surface material; tree species, grade, source, size, moisture content.
3. Foam gaskets; thickness, width, foam compressibility.
4. Form release coating.
5. Repair materials.
6. Reinforcing accessories.
7. Form ties and tie clamps.
8. Curing compound; base material type.
9. Solution for surface finish, each type.
10. Water repellant sealer.
11. Inserts and embedments, each type.
12. Crack control internal devices, each type.

C. Samples: As applicable, submit the following samples listed below:

1. Smooth formwork contact materials, each type, 12-inches square.
2. Reveal form strips, each size, 12-inches long
3. Foam gaskets, 12-inches long.
4. Crack control internal devices, each type, 12-inches long.
5. Form ties, one each type, 12-inches long.
6. Exposed aggregates.
7. Form liners.

D. Formwork Shop Drawings:

1. Submit drawings showing the layout and details of formwork for the work, including the mock-ups.
2. Drawings shall include plans, elevations and sections to show the layout of all exposed-to-view concrete work and interfacing adjacent concrete work.
3. Include the following in shop drawings:
    a. Details of formwork, construction and control joints, reveals, recesses, embedments, and ties. When applicable, back-up, clean-out panels, and lost formwork shall be included.
    b. The means to be used to seal all joints.
    c. The means to be used to maintain alignment, including back-up bracing, etc.
    d. Cover of concrete over reinforcing steel.
    e. Location of clear placing passages through the steel reinforcing for placing trunks and hoses.

1.5 QUALITY ASSURANCE

A. The work of this section shall be performed by a concrete contractor which specializes in the type of Cast-in-Place Architectural Concrete work required for this project, with a minimum of 5-years of documented successful experience and shall be performed by skilled workmen thoroughly trained in the necessary crafts to perform architectural concrete work

B. The Cast-in-Place Architectural Concrete contractor, carpenter foreman, labor foreman and the reinforcing erector foremen shall have successful experience in performing Cast-in-Place

Architectural Concrete work that shows the ability to perform architectural quality work and shall be approved for work on project.

C. Pre-Construction Meeting: After approval of submittals and as early as possible, but not less than 15 days prior to the fabrication of the formwork, the Contractor shall schedule a meeting at a mutually agreed time. The meeting shall include the Landscape Architect, the Cast-in-Place Architectural Concrete Contractor, Architect, and the General Contractor.

D. Mockups: After submittals and shop drawings of the mock-up are approved, construct mock-ups of the Cast-in-Place Architectural Concrete work in a location approved by the Landscape Architect and as detailed in the approved shop drawing.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301.

1.8 PERFORMANCE REQUIREMENTS

A. Responsibility for the design of Cast-in-Place Architectural Concrete in conformance with the requirements of the drawings and specifications and performed using the highest standards of quality for visual and durable concrete rests with the contractor.

B. Formwork shall be constructed to resist concrete pressures regarding surface stability and also joint tightness to meet the specified requirements.

C. All concrete shall be performed so that no evidence of the following will be evident when the concrete is subject to imposed loads, temperature and weather conditions:
1. Damage of any kind.
2. Formwork fastening penetrations or formwork anchoring devices or projections other than approved form ties and specified embedded items.
3. Cracking, other than at control joints, due to improper forming, placing and curing.
4. Out of alignment or incorrect profiles.
5. Surface voids not completely covered by a circle 11/16 inches in diameter (10 cent coin) or more than 25 surface voids larger than 1/8 inch, in longest dimension, in any area 3ft x 3 ft. square.
6. Voids, sand pockets or discoloration due to fluid loss through the formwork.

7. Rockpockets and honeycombs.
8. Discoloration caused from staining and/or from improper placing of the concrete.
9. If any of the above-mentioned deficiencies occur, the Landscape Architect may order the affected concrete replaced or repaired with acceptable results. Repair only when directed by the Landscape Architect. Corrected deficiencies must be approved by the Landscape Architect. All remedial work shall be performed and submitted as tests prior to any repair work being accomplished.

D. Design Reference Sample: The following precedent images represent the typical finished quality expected of the Cast-in-Place Architectural Concrete these images should be used when developing the mock-up:

1.





2.



PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301
2. ACI 303.1.

2.2 FORMWORK MATERIALS

A. Smooth Surface Formwork:

1. Flat form surfaces shall be plastic coated, 3/4-inch thick panels in sizes to cover areas between joint lines shown on the drawings. Panel approved for use shall be used for all surfaces designated for that specific panel. Panels shall be as follows or as approved equal:

   a. Panels shall be 14-layers per inch, birch plywood with face layer parallel with panel length and a minimum 3/32” high density plastic overlay.

2. All formwork panels shall have sealed, square edges and corners. Butted edges of panels, when multiple panels are assembled together, shall not vary more than 1/32 inch in 10 ft in any butted joint.

B. Form Ties: Shall be manufactured specifically for use as concrete ties and shall be designed to seal tightly to the form face material without fluid loss. Ties shall be of sufficient strength to resist fluid concrete placing pressures at the longest span of support used in project.

C. Joint Sealing Material: Seal formwork abutting edge conditions against fluid loss utilizing the following:

1. Foam gaskets for sealing field erected corner form joints shall be highly compressible foam rubber or neoprene tape, paper backed, with pressure sensitive adhesive on one side, and shall be of sufficient width and thickness for specific use.
2. Sealant for sealing permanent shop or bench fabricated unrevealed joints shall be non-staining, silicone caulking.

D. Form Release Coating for all formwork surfaces: Colorless, non-staining and having no deleterious effects on the concrete, manufactured specifically for non-absorbent surfaces and for reducing surface voids.

E. Crack Control Joints:
1. Internal (installed within the concrete) crack control devices for exposed surfaces shall be coated steel bar assemblies.
2. External crack control devices for exposed surfaces shall be stainless steel devices.

2.3 STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

2.4 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I, gray. Provide from a single source.
2. Fly Ash: ASTM C618, Class F. Provide from a single source.
3. Slag Cement: ASTM C989, Grade 100 or Grade 120. Provide from a single source.

C. Normal-Weight Aggregates: ASTM C 33, graded. Provide from a single source.

1. Maximum Coarse-Aggregate Size: 3/4-inch nominal.
2. Fine aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that does not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 101, Type II.

F. Concrete Bonding Adhesive: Use bonding adhesives according to manufacturer’s written instructions

1. ASTM C 1059, Type I and Type II.

G. Water: Potable, complying with ASTM C 94.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating.

E. Water: Potable, complying with ASTM C 94.

2.6 REPAIR MATERIALS

A. Trowel applied, single component, cement based material specifically formulated for rubbing, smoothing, repairing, and restoring architectural concrete surfaces.

1. Product: Dayton Superior, Architectural Finish™, or approved equal.

2.7 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25-percent
2. Combined Fly Ash and Pozzolan: 25-percent.
3. Ground Granulated Blast Furnace-Slag: 50-percent
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50-percent Portland cement minimum, with fly ash or pozzolan not exceeding 25-percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing, admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete.

D. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide Cast-in-Place Architectural Concrete of consistent quality in appearance and physical properties.

E. Cementitious Materials: For Cast-in-Place Architectural Concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.

F. Concrete Mixtures:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 2-inches inches, plus or minus 1 inch.

4. Air Content: 5-percent, plus or minus 1.5-percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice"

2.10 CONCRETE MIXING

A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

C. In addition to ACI 303.1 limits on form-facing panel deflection, limit Cast-in-Place Architectural Concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch.

D. Construct forms to result in Cast-in-Place Architectural Concrete that complies with ACI 117.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.

1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.

2. Do not use rust-stained steel form-facing material.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of Cast-in-Place Architectural Concrete as shown on Landscape Architectural drawings.

033301-2 H. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

M. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

N. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form-liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 REINFORCEMENT AND INSERT INSTALLATION

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Schedule form removal to maintain surface appearance that matches approved mockups.
2. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.

B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for Cast-in-Place Architectural Concrete surfaces.

3.4 JOINTS

A. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of Cast-in-Place Architectural Concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Landscape Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete. Align construction joint within rustications attached to form-facing material.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

B. Contraction Joints: Form weakened-plane contraction joints true to line, with faces perpendicular to surface plane of Cast-in-Place Architectural Concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Landscape Architect.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Landscape Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.

3.6 FINISHES, GENERAL

A. Architectural Concrete Finish: Match approved mock-up to the satisfaction of the Landscape Architect.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

D. Sandblasting and Staining Design Reference Sample: The following precedent images represent the typical finished quality expected of sandblasted and stained concrete. These images should be used when developing the mock-up:





3.7 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Begin curing Cast-in-Place Architectural Concrete immediately after removing forms from concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.8 FIELD QUALITY CONTROL

A. General: Comply with field quality-control requirements in Section 033000 "Cast-in-Place Concrete."

3.9 REPAIR, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of Cast-in-Place Architectural Concrete when approved by Landscape Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

1. Remove and replace Cast-in-Place Architectural Concrete that cannot be repaired and cured to Landscape Architect's approval.

B. Protect corners, edges, and surfaces of Cast-in-Place Architectural Concrete from damage; use guards and barricades.

C. Protect Cast-in-Place Architectural Concrete from staining, laitance, and contamination during remainder of construction period.

D. Clean Cast-in-Place Architectural Concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.

1. Do not use cleaning materials or processes that could change the appearance of Cast-in-Place Architectural Concrete finishes.

END OF SECTION

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SECTION 033500 - CONCRETE FLOOR SEALERS/DENSIFIERS/HARDENERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface treatment with concrete hardener and sealer.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

1.3 SUBMITTALS

A. Product Data: Provide data on concrete hardener and sealer, including information on compatibility of different products and limitations.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301 and ACI 302.1R.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s sealed packaging, including application instructions.

1.6 PROJECT CONDITIONS

A. Coordinate the work with concrete floor placement and concrete floor curing.

B. Maintain ambient temperature of 50 degrees F minimum.

PART 2 - PRODUCTS

2.1 COMPOUNDS, HARDENERS AND SEALERS

A. Chemical hardener: Clear, chemically reactive, waterborne solution of inorganic siliconate materials and proprietary components, odorless, colorless, that penetrates, hardens, and densifies concrete surfaces.

1. VOC Content: Not to exceed 200 g/L.

2. Acceptable Products:

   a. Ashford Formula, Concrete Chemical Company, Inc.
   b. Seal Hard, L & M Construction Chemicals, Inc.
   c. Titan Hard, Burke Construction Chemicals.
   d. Euco Diamond Hard, Euclid Chemical Company

PART 3 - EXECUTION

3.1 FLOOR SURFACE TREATMENT

A. Prepare surface in accordance with manufacturer's instructions.

B. Clean concrete surfaces of dirt, dust, debris, oil, grease, bond-breaker compounds, curing compounds, sealers, laitance, paint and other contaminants which could adversely affect liquid concrete floor hardener penetration.

C. Apply hardener to floor surfaces in accordance with manufacturer's instructions.

END OF SECTION – 033500

SECTION 033900 - CONCRETE CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Initial and final curing of horizontal concrete surfaces.

1.2 REFERENCE STANDARDS

A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.

B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.

C. ACI 305R – Hot Weather Concreting; American Concrete Institute.

D. ACI 306R – Cold Weather Concreting; American Concrete Institute.

E. ACI 308R – Guide to Curing Concrete; American Concrete Institute.

F. ASTM C 171 – Standard Specification for Sheet Materials for Curing Concrete.

G. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

H. ASTM D 2103 – Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on curing compounds, moisture-retaining sheet, and polyethylene film, including compatibility of different products and limitations.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1R.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Membrane Curing Compound: ASTM C 309 Type 1 – Clear or translucent, Class B.

1. VOC Content not to exceed 350 g/L.

C. Moisture-Retaining Sheet: ASTM C 171.

1. Curing paper, regular.
2. Polyethylene film, clear, minimum nominal thickness of 0.0040 in.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd., 40 inches wide.

D. Polyethylene Film: ASTM D 2103, 4 mil thick, clear.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION – HORIZONTAL SURFACES

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R for cold-weather protection and ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure floor surfaces in accordance with ACI 308.

D. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges; maintain in place for not less than 4 days.

E. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.

F. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in one coat.

3.3 EXECUTION – VERTICAL SURFACES

A. Cure surfaces in accordance with ACI 308.

B. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.4 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION – 033900

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SECTION 040310 - HISTORIC MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of cleaning historic clay brick and stone masonry surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray:

1. Pressure: 100 to 400 psi.
2. Flow Rate: 4 to 6 gpm.

B. Medium-Pressure Spray:

1. Pressure: 400 to 800 psi.
2. Flow Rate: 4 to 6 gpm.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to masonry historic treatment and cleaning.
2. Review methods and procedures related to cleaning historic masonry.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic masonry cleaning specialist. Experience cleaning new masonry work is insufficient experience for historic treatment work.

B. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. (20 L) of solution required.

D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner based on phosphoric, oxalic, or citric acid; but not containing muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

H. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.

I. One-Part Limestone Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.

2.2 CHEMICAL-CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

B. Acidic Cleaner Solution for Brick: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 CLEANING MASONRY, GENERAL

A. Have cleaning work performed only by qualified historic treatment specialist.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.

a. Equip units with pressure gauges.
b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

D. Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

1. Keep wall wet below area being cleaned to prevent streaking from runoff.

E. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface, and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

F. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

G. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.3 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, caulking, asphalt, and tar.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.

3.4 CLEANING BRICKWORK

A. Detergent Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold or hot water applied by low or medium-pressure spray to remove detergent solution and soil as required by cleaning solution manufacturer.
4. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with cold or hot water applied by low or medium-pressure spray to remove mold, mildew, and algae remover and soil as required by cleaning solution manufacturer.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

C. Nonacidic Gel Chemical Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Remove bulk of gel cleaner.
5. Rinse with cold or hot water applied by low-pressure-pressure spray to remove chemicals and soil as required by cleaning solution manufacturer.
6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

D. Nonacidic Liquid Chemical Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold or hot water applied by low-pressure-pressure spray to remove chemicals and soil as required by cleaning solution manufacturer.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

E. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by spray to remove chemicals and soil as required by cleaning solution manufacturer.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

F. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.

4. Rinse with cold water applied by spray to remove chemicals and soil as required by cleaning solution manufacturer. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.5 CLEANING UNPOLISHED STONEWORK

A. Detergent Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with warm water applied by low or medium-pressure spray to remove detergent solution and soil or as required by manufacturer’s directions.
4. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply mold, mildew, and algae remover by natural brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with warm water applied by low or medium-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

C. Nonacidic Gel Chemical Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer or established by mockup.
4. Remove bulk of gel cleaner.
5. Rinse with warm water applied by low or medium-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

D. Nonacidic Liquid Chemical Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold or hot water applied by low or medium-pressure spray to remove chemicals and soil as required by cleaning solution manufacturer.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

E. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacture.
4. Rinse with cold water applied by spray to remove chemicals and soil as required by cleaning solution manufacturer.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

F. One-Part Limestone Chemical Cleaning:

1. Wet surface with cold or hot water applied by low-pressure spray as required by cleaning solution manufacturer.
2. Apply cleaner to surface by brush or low-pressure spray as required by cleaning solution manufacturer.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
5. Rinse with cold or hot water applied by medium-pressure spray to remove chemicals and soil as required by cleaning solution manufacturer. .

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage chemical-cleaner manufacturer's factory-authorized service representatives for consultation and Project-site inspection and provide on-site assistance when requested by Architect. Have chemical-cleaner manufacturer's factory-authorized service representatives visit Project site not less than twice to observe progress and quality of the Work.

END OF SECTION 040310

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SECTION 040322 - HISTORIC BRICK UNIT MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of repairing historic clay brick masonry.

B. Related Requirements:

1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

1.2 DEFINITIONS

A. Low-Pressure Spray:

1. Pressure: 100 to 400 psi.
2. Flow Rate: 4 to 6 gpm.

B. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to masonry historic treatment and repair.
2. Review methods and procedures related to repairing historic brick masonry.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of masonry repair work on the structure.
2. Show provisions for expansion joints or other sealant joints.
3. Show replacement and repair anchors. Include details of anchors

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction test reports.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic brick masonry repair specialist. Experience installing standard unit masonry is insufficient experience for masonry historic treatment work.

1. Historic Treatment Worker Qualifications: When bricks are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products.

B. Mockups: Prepare mockups of historic treatment to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:

a. Replacement: Four brick units replaced.
b. Patching: Three small holes at least 1 inch in diameter for each type of brick indicated to be patched, so as to leave no evidence of repair.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on brick masonry as follows:

1. Replacement Brick: Test each proposed type of replacement brick, according to sampling and testing methods in ASTM C67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: Units, including molded, ground, cut, or sawed shapes as required to complete masonry repair work.

1. Brick Matching Existing: Reuse existing brick being removed and/or use units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.

    a. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.

2. Special Shapes:

    a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position, and where shapes produced by sawing would result in sawed surfaces being exposed to view.
    b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
    c. Mechanically chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.

B. Building Brick: ASTM C62, Grade SW where in contact with earth, Grade SW, MW, or NW for concealed backup; of same vertical dimension as face brick, for masonry work concealed from view.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II; white or gray or both where required for color matching of mortar.

B. Hydrated Lime: ASTM C207, Type N.

C. Mortar Sand: ASTM C144 unless otherwise indicated.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
3. For exposed mortar, provide sand with rounded edges.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

E. Water: ASTM C270, potable.

2.3 MANUFACTURED REPAIR MATERIALS

A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.

1. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than the bricks being repaired, and develops high bond strength to all types of masonry.
2. Formulate patching compound used for patching brick in colors and textures to match each unit being patched. Provide sufficient number of colors to enable matching the color, texture, and variation of each unit.

2.4 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.

2.5 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.
2. Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Prevent mortar from staining face of surrounding masonry and other surfaces.

B. Remove downspouts and associated hardware adjacent to immediate work area, and store during masonry repair work. Reinstall when repairs are complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 MASONRY REPAIR, GENERAL

A. Have repair work performed only by qualified historic treatment specialist.

3.3 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions, including voids, cracks, bulges, loose masonry units in existing backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible. Remove mortar and sealant from surfaces of removed units.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.

H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

1. Maintain joint width for replacement units to match existing joints.
2. Use setting buttons or shims to set units accurately spaced with uniform joints.

I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.

1. Rake out mortar used for laying brick before mortar sets according to Section 040323 "Historic Brick Unit Masonry Repointing." Point at same time as repointing of surrounding area.
2. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.4 BACKUP MASONRY REMOVAL AND REPLACEMENT

A. Where backup masonry is fractured or unstable and at locations indicated, remove mortar and masonry units that are broken or deteriorated and rebuild with whole, new brick or whole salvaged backup masonry units. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Perform backup masonry removal and replacement according to requirements in "Brick Removal and Replacement" Article.

3.5 BRICK MASONRY PATCHING

A. Patch the following bricks unless another type of repair or replacement is indicated:

1. Units indicated to be patched.

B. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch(es) thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

3.6 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040322

SECTION 040323 - HISTORIC BRICK UNIT MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of repointing brick masonry joints.

B. Related Requirements:

1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

1.2 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. Low-Pressure Spray:

1. Pressure: 100 to 400 psi.
2. Flow Rate: 4 to 6 gpm.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to masonry historic treatment and repointing.
2. Review methods and procedures related to repointing historic brick masonry.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic masonry repointing specialist. Experience in pointing or repointing only new or nonhistoric masonry is insufficient experience for masonry historic treatment work.

B. Mockups: Prepare mockups of historic treatment on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Repointing: Rake out joints in area approximately 36 inches high by 48 inches wide for each type of repointing required, and repoint.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II; white or gray or both where required for color matching of mortar.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Sand: ASTM C144 unless otherwise indicated.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

E. Water: ASTM C270, potable.

2.2 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black, which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Pointing Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Prevent mortar from staining face of surrounding masonry and other surfaces.

B. Remove downspouts and associated hardware adjacent to immediate work area and store during masonry repointing work. Reinstall when repointing is complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 MASONRY REPOINTING, GENERAL

A. Have repointing work performed only by qualified historic treatment specialist.

3.3 REPOINTING

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints indicated as sealant-filled joints. Seal joints according to Section 079200 "Joint Sealants."
3. Joints at locations of the following defects:

a. Holes and missing mortar.
b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
c. Cracks 1/16 inch(es) or more in width and of any depth.
d. Hollow-sounding joints when tapped by metal object.
e. Eroded surfaces 1/4 inch or more deep.
f. Deterioration to point that mortar can be easily removed by hand, without tools.
g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of joint width plus 1/8 inch and not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches deep; consult Architect for direction.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of bricks or widen joints. Replace or patch damaged bricks as directed by Architect.

    a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.

D. Notify Architect of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 1/8 inch(es) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch(es). Fully compact each layer and allow it to become thumbprint hard before applying next layer. Where existing brick have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

    a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
    b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Remove mortar and repoint.

F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.4 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040323

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SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Brick.
4. Mortar and grout materials.
5. Reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Accessories.
9. Mortar and grout mixes.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.

C. Samples: For each type and color of exposed masonry unit and colored mortar.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product and for masonry units, include data on material properties material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.6 QUALITY ASSURANCE

A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panel for typical exterior wall in sizes approximately 48 inches long by 36 inches high.

1.7 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90, normal weight unless otherwise indicated.

C. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 316.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view and as indicated in drawings.

B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).

1. Brick as selected by Architect or architect approved equal to match existing.
   a. Basis of design: Continental #411, Continental Brick, 154 Charles Town Road, Martinsburg, WV 25405, 304-263-6974
2. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
3. Size (Actual Dimensions): match existing brick.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

G. Aggregate for Grout: ASTM C404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Wire Size for Veneer Ties: 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

D. Masonry-Joint Reinforcement for Multi-wythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized carbon steel continuous wire.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated bent to configuration indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

G. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
3. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive thermal wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing and a coating to reduce thermal conductivity.

2.7 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Stainless Steel Fabric Flashing: Composite, flashing product consisting of .003-inch Type 304 stainless steel sheet, bonded to a layer of polymeric fabric.
   a. Use pre-manufactured corners, end dams and other shapes as necessary.
   b. Lifetime warranty.

2. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of .003 inch of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 10 mil or 40 mil.
   a. Applications: Use 10-mil- thick flashing at windows, doors, and small wall penetrations; not at base of walls. Use 40-mil- thick flashing at base of walls.
   b. Use pre-manufactured corners, end dams and other shapes as necessary.
   c. Lifetime warranty.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch.

2.8 ACCESSORIES

A. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

B. Weep/Cavity Vents: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

D. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime, mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. Masonry below grade and in contact with earth: Type M.
2. Exterior, load-bearing masonry: Type S.
3. Exterior, Brick Veneer: Type N.
4. Interior, Load bearing masonry: Type S.
5. Interior non-load-bearing masonry, Type S.

D. Pigmented Mortar: Use colored cement product**.** Do not add pigments to colored cement products.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.

E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp,

unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/4 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft, 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in Monk Bond (similar to Flemish bond) to match existing building; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Bond Pattern for CMU: Unless otherwise indicated, lay CMU units in running bond with coursing such that one unit and one mortar joint equal 8 inches.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:

1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 12 inches, and through inner wythe to within 1/2 inch of

the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.

3. At lintels and shelf angles, extend flashing 6 inches minimum at each end. At heads and sills, extend flashing 6 inches minimum and turn ends up not less than 2 inches to form end dams.
4. Install metal drip edges with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.10 REINFORCED UNIT MASONRY

A. Placing Reinforcement: Comply with requirements in TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.12 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

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SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members, support members and struts.

B. Base plates, embedded plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.2 REFERENCE STANDARDS

A. AISC (MANUAL) – Steel Construction Manual; American Institute of Steel Construction, Inc.

B. AISC S303 – Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.

C. AISC S348 – Specification for Structural Joints Using ASTM A325 or A490 Bolts.

D. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.

E. ASTM A 53/A 53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

F. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

G. ASTM A 123/A 123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

I. ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

J. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

K. ASTM A 490 – Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.

L. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

M. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts.

N. ASTM A 992/A 992M – Standard Specification for Structural Steel Shapes.

O. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

P. ASTM E 94 – Standard Guide for Radiographic Examination.

Q. ASTM E164 – Standard Practice for Ultrasonic Contact Examination of Weldments.

R. ASTM E 165 – Standard Test Method for Liquid Penetrant Examination.

S. ASTM E 709 – Standard Guide for Magnetic Particle Examination.

T. ASTM F 436 – Standard Specification for Hardened Steel Washers.

U. ASTM F 959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

V. ASTM F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength.

W. AWS A2.4 – Standard Symbols for Welding, Brazing, and Non-Destructive Examination.

1. American Welding Society.

X. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.

Y. IBC 2018 – International Building Code.

1.3 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, and locations of structural members.
2. Include details of cuts, openings, attachments, fasteners, splices and camber.
3. Detail all connections.

    a. Indicate pre-tensioned and slip-critical high-strength bolted connections.
    b. Indicate welded connections with AWS welding symbols. Include type, size and length.
    c. Indicate all AWS weld designations for pre-qualified full and partial penetration welds and detail all joint preparations.

4. Provide erection details for all field welded connections.
5. For structural-steel connections indicated to comply with design loads, connections and structural analysis data shall be signed and sealed by the qualified professional engineer registered in the State of Maryland responsible for their preparation.

C. AISC certification for fabricator and erector or required additional documentation for non-AISC certified fabricator and erector.

D. Mill Test Reports: Signed by manufacturer certifying that the product complies with specified requirements. Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

F. Quality control test reports for shop and field including ultrasonic test results.

1. Submit certification by a Professional Engineer registered in the State of Maryland that all joint preparation for complete joint penetration welds meet AISC requirements and that all welding procedure specification requirements have been met.

1.4 QUALITY ASSURANCE

A. Structural steel shall be domestic origin, produced and supplied from the United States of America only.

B. Fabricate structural steel members in accordance with AISC “Steel Construction Manual” and AISC “Code of Standard Practice for Steel Buildings and Bridges”.

C. Comply with Section 10 of AISC “Code of Standard Practice for Steel Buildings and Bridges” for architecturally exposed structural steel.

D. Welding: Comply with AWS D1.1, “Structural Welding Code-Steel” for procedures, tolerances, appearance and quality.

E. Fabricator: Engage a firm experienced in fabricating structural steel similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Provide documentation that fabricator has provided material for and erected at least 3 projects of similar complexity in the last six years.
2. Allow the Owner’s representative to visit the fabrication plant as required to inspect in place quality control procedures and structural steel fabrication.
3. Fabricators who are not an AISC Certified Building Fabricator (BU), shall meet the following additional requirements:

a. Demonstrate that the fabricator has in place a quality control program for meeting IBC requirements and compliance with AISC recommendations and standards.
b. At no additional cost to the Owner, provide an independent shop inspection for compliance with IBC, AISC and AWS recommendations and standards. The independent inspection agency shall be different than the testing agency engaged by the Owner.
c. Shop inspection tasks required by AISC 360 to be performed by the fabricator’s quality control personnel, shall be overseen by the independent inspector hired by the fabricator.

d. At completion of fabrication, and prior to erecting steel, submit a certificate of compliance signed and sealed by the third party inspector, stating that the steel fabrication complies with the requirements of the construction documents.
e. Shop drawings shall be signed and sealed by a professional engineer, registered in the local jurisdiction, responsible for the design of the connections. The professional engineer shall carry a minimum of $1,000,000.00 of professional liability insurance.
f. The steel fabricator shall provide field repair details, along with computations, for all required field modifications. The details and calculations shall be signed and sealed by the same professional engineer that certified the shop drawings.

F. Erector: Engage a firm experienced in erecting structural steel similar to that indicated for the project with a record of successful in-service performance.

1. Provide documentation that the erector has erected at least 3 projects of similar complexity in the last six years.
2. Erectors who are not an AISC Certified Steel Erector (CSE) shall meet the following additional requirements:

a. Provide an erection procedure safety document with cover letter, signed and sealed by a professional engineer registered in the State of Maryland, that states the document has been reviewed and is in conformance with erection procedures required by AISC.

G. Design connections not detailed on the drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Maryland.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off the ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause deterioration, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.7 UNIT PRICES

A. Provide unit prices for additions to and deductions from the contract.

B. Unit prices shall include all labor and material required for the complete installation of structural steel work, including shop drawing preparation and revisions, ordering materials, engineering, fabrication, delivery, erection and painting.

C. Provide unit prices for two (2) classifications of steel, which shall cover all categories of structural steel required for this project.

1. Classification 1 – Main Steel Framing: This shall include columns, posts, hangers, beams, girders, trusses and connections. It shall also include base plates, bearing plates, stiffeners, angles, etc., which become part of the framing.
2. Classification 2 – Light Steel Framing: This shall include sub-framing for various purposes, such as mechanical openings and framing of a similar nature that may be required for the construction of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel angles, Channels and Plates: ASTM A 36/A 36M. ASTM A 572 where plate is noted on plans to have a yield strength of 50 ksi.

B. Steel W Shapes and Tees: ASTM A 992/A 992M.

C. Cold-Formed Structural Tubing: ASTM A 500, Grade C.

D. Pipe: ASTM A 53/A 53M, Grade B, Finish black.

E. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars. Headed stud type.

F. Rods: ASTM A 36/A 36M.

G. Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A.

H. High-Strength Structural Bolts, Nuts, and Washers: ASTM A 325, with matching ASTM A 563 nuts and ASTM F 436 washers; Type 1, medium carbon, plain. Bolts and nuts shall be heavy hex.

I. High Strength Structural Bolts: ASTM A 490, with matching ASTM A 563 nuts and ASTM F 436 washers; Type 1 alloy steel. Bolts and nuts shall be heavy hex.

J. Anchor Rods: ASTM F 1554, Grade 36, plain, with matching ASTM A 563 nuts and ASTM F 436 washers.

K. Load Indicator Washers: Provide washers complying with ASTM F 959 at all connections requiring pre-tensioned high-strength bolts.

L. Welding Materials: AWS D1.1; type required for materials being welded.

M. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

N. Shop and Touch-Up Primer: Type specified in Section 099120, complying with VOC limitations of authorities having jurisdiction.

O. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.2 FABRICATION

A. Shop fabricate to the greatest extent possible.

B. Develop required camber for members.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements of AWS D1.1.

D. Bolt Holes: Drill or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

2.3 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

B. Surface preparation: SSPC-SP2: "Hand Tool Cleaning" or SSPC-SP3, "Power Tool Cleaning".

1. Refer to Division 9 for preparation of surfaces that are to receive coatings other than shop primer.

C. Provide a dry film thickness of not less than 1.5 mil.

D. Galvanize structural steel members to comply with ASTM A 123/A 123M. Provide minimum 1.7 oz/sq ft. galvanized coating. Galvanize shelf angles, lintels and hung plates located in exterior walls. Galvanize all exterior steel.

2.4 SOURCE QUALITY CONTROL

A. An independent testing agency will perform source quality control tests, as specified in Section 014000. Inspection services shall conform to Section 1705.2 of the 2018 IBC Code, the quality assurance inspection requirements of AISC 360 and the Statement of Special inspections noted in the structural drawings.

B. High-Strength Bolts: Provide testing and verification of all shop-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Pre-tensioned and slip-critical bolts shall be installed using direct-tension-indicator washer method or twist-off type tension control bolt method.

C. Welded Connections: Visually inspect all shop-welded connections and test all full penetration welds using ultrasonic testing performed in accordance with ASTM E 164.

1. Inspect all joint preparations for complete joint penetration welds and verify compliance with welding procedure specification requirements.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel in compliance with AISC “Code of Standard Practice for Steel Buildings and Bridges”.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer’s written instructions.

E. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts”.

F. Do not field cut or alter structural members without the approval of the Architect.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete and surfaces that will be fireproofed. Repair damaged galvanized coatings with galvanized repair paint.

H. Grout solidly between column plates and bearing surfaces, complying with manufacturer’s instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.2 TOLERANCES

A. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC’s “Code of Standard Practice for Steel Buildings and Bridges”.

3.3 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000. Inspection services shall conform to Section 1705.2 of the 2018 IBC Code, the

quality assurance inspection requirements of AISC 360 and the Statement of Special Inspections noted in the structural drawings.

B. High-Strength Bolts: Provide testing and verification of all field-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Pre-tensioned and slip-critical bolts shall be installed using direct-tension-indicator washer method or twist-off type tension control bolt method.

C. Welded Connections: Visually inspect all field-welded connections and test all full penetration welds using ultrasonic testing performed in accordance with ASTM E 164.

1. Inspect all joint preparations for complete joint penetration welds and verify compliance with welding procedure specification requirements.

D. In addition to visual inspection, field-welded shear connectors shall be tested and inspected according to the requirements of AWS D1.1 for stud welding.

E. Correct deficiencies in work that inspections indicate does not comply with the specified requirements.

END OF SECTION – 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof deck.

B. Supplementary framing for openings up to and including 12 inches.

C. Bearing plates and angles.

D. Stud shear connectors.

1.2 REFERENCE STANDARDS

A. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.

B. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

C. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A 1008/A 1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened.

E. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.

F. AWS D1.3 – Structural Welding Code – Sheet Steel, American Welding Society.

G. SDI (DM) – Publication No. 31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute.

H. SSPC-Paint 20 – Zinc-Rich Primers (Type I, “Inorganic”, and Type II “Organic”); The Society for Protective Coatings.

1.3 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittals procedures.

B. Shop Drawings: Indicate deck plan, support locations, anchorage details, projections, openings, reinforcement, cellular raceways and outlet box locations, pertinent details, and accessories.

C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Welders Certificates: Certify welders employed on the Work are certified to perform welding according to AWS requirements with AWS 1.3 qualification within the previous twelve months.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum of 5 years of documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers, slope for positive drainage.

PART 2 - PRODUCTS

2.1 STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), with G60/Z180 galvanized coating.

a. Grade 50.

B. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Designation SS, with G60/Z180 galvanized coating.

a. Grade 50.

2.2 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A 36/A 36M steel.

B. Stud Shear Connectors: Made from ASTM A 108/A 108M Grade 1015 bars.

C. Welding Materials: AWS D1.1.

D. Fasteners: Galvanized hardened steel, self tapping screws, No. 10 minimum.

E. Weld Washers: Mild steel, uncoated, ¾ inch outside diameter, 1/8 inch thick.

F. Shop and Touch-Up Primer: Type specified in Section 099120, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.3 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gage minimum thick sheet steel; of profile and size as indicated; material and finish same as deck.

B. Cant Strips: Formed sheet steel, 16 gage thick, 45 degree slope, 3½ inch nominal width and height, flange for attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before permanently fastening.

C. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck and support of other work.

D. Weld deck in accordance with AWS D1.3.

E. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

F. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

G. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

H. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

I. Place metal cant strips in position and field weld.

J. Weld stud shear connectors through steel deck to structural members below.

K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1½ inches long, and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge ribs of panel at each support; space additional welds at 12” o.c. and as indicated on Drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as indicated on Drawings.

1. Mechanically fasten with self-drilling, No.10 diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1½ inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1½ inches, with end joints lapped 2 inches minimum.

3.4 FLOOR DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge ribs of panel at each support and at 12” on center and as indicated on drawings.

B. Side-lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as indicated on Drawings.

1. Fasten with a minimum of 1½ inch long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1½ inches, with end joints butted.

3.5 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000. Inspection services shall conform to Section 1705.2 of the 2018 IBC Code and the Statement of Special Inspections noted in the structural drawings.

B. Inspection shall include, but not be limited to, deck alignment, support, welds, side lap attachments and touch-up galvanizing.

C. Remove and replace work that does not comply with specified requirements.

END OF SECTION – 053100

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior non-load-bearing wall framing.
2. Miscellaneous framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Interior non-load-bearing wall framing.
3. Vertical deflection clips.
4. Single deflection track.
5. Drift clips.
6. Post-installed anchors.
7. Power-actuated anchors.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

C. Product test reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports:

1. For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA).

1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed steel framing that are similar to those indicated for this Project in material, design, and extent.

D. Testing Agency Qualifications: Qualified in accordance with ASTM E329 for testing indicated.

E. Product Tests: Mill certificates or data from a qualified independent testing agency[, or in-house testing with calibrated test equipment,] indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

F. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA).

G. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel.

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

H. Fire-Test-Response Characteristics: Where indicated, provide cold-formed steel framing identical to that of assemblies tested for fire resistance per ASTM E119 by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.

I. Comply with the following AISI specifications and standards:

1. AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members."
2. AISI S200, "North American Standard for Cold-Formed Steel Framing - General Provisions."
3. AISI S201, "North American Standard for Cold-Formed Steel Framing - Product Standard.
4. AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."
5. AISI S240, "North American Standard for Cold-Formed Steel Structural Framing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.

B. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

1. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
2. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240of the wall height under a horizontal load of 5 lbf/sq. ft.
3. Interior Non-Load-Bearing Framing at ceramic tile locations: Horizontal deflection of 1/360of the wall height under a horizontal load of 5 lbf/sq. ft.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and ASTM C955, AISI S200, ASTM C955, Section 8, and AISI S240.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.
3. Section Properties: L/240

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

D. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.
3. Type Box Header Clip (BHC): Size as required by design.

    a. Minimum Base-Steel Thickness: 0.0428 inch.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.

2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F194, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire

integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.2 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to[bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to studs and anchor to building structure.
3. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.3 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 054000

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Metal ladders.
3. Elevator pit sump cover.
4. Miscellaneous steel trim.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Manufactured metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples: For each type and finish of extruded nosing.

D. Delegated Design Submittals: For ladders including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

F. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel.
2. Provide bronze fasteners for fastening bronze.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. the same size as pipe wall thickness unless otherwise indicated.

2.6 METAL LADDERS

A. General:

1. Comply with ANSI A14.3**,** except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Galvanize and prime ladders, including brackets.

2.7 ELEVATOR PIT SUMP COVER

A. Fabricate from 1/8-inch rolled-steel floor plate with four 1-inch- diameter holes for water drainage and for lifting.

B. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c. evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

C. Apply bituminous paint to concealed surfaces of cast-metal units.

D. Apply clear lacquer to concealed surfaces of extruded units.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize and prime loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.4 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.5 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.6 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.7 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Woven-wire mesh.
2. Welded-wire mesh.
3. Vinyl nosings.
4. Shop primer products.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated Design Submittal: For stairs railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/720.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces>.

2.2 METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

C. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3 VINYL NOSINGS

A. Vinyl Stair Nosings

1. Basis of Design: Tarkett Vinyl Stair Nosings, RCN XX A

2. Manufactured from a homogeneous composition of polyvinyl chloride (PVC), high quality additives, and colorants to meet the performance requirements of ASTM F-2169 Standard Specification for Resilient Stair Treads, Type TV, Class 1 and 2, Group 1 and 2.

3. Slip Resistance: ASTM D 2047 - Exceed Federal Standards and ADA recommendations of .6 for flat surfaces.

4. Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) - Class 1.

5. Adhesives: Two-part Epoxy.

2.4 FASTENERS

A. General: Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594 (ASTM F836M).

2.5 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: Cast stainless steel, center of rail 3-1/8 inches from face of wall.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

C. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I, and compatible with topcoat.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and

nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Stringers: Fabricate stringers of steel rectangular tubes as indicated on Drawings.

a. Stringer Size: As indicated on Drawings.
b. Provide closures for exposed ends of channel and rectangular tube stringers.
c. Finish: Painted.

2. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

3. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Steel Sheet: Uncoated, cold-rolled steel sheet unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

E. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.2 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099124 "Interior Painting MPI Standards"

END OF SECTION 055113

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel railings.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Handrail brackets.
3. Shop primer.
4. Intermediate coats and topcoats.
5. Bituminous paint.
6. Nonshrink, nonmetallic grout.
7. Anchoring cement.
8. Metal finishes.
9. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish.

D. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated design professional engineer.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed).

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/ASTM F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron, 2-1/2 inches from wall or as indicated on drawings.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shop Primers: Provide primers that comply with Section 099124 "Interior Painting (MPI Standards)." Or Section 099600 "High-Performance Coatings."

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

H. Intermediate Coats and Topcoats: Provide products that comply with Section 099124 "Interior Painting (MPI Standards)." or Section 099600 "High-Performance Coatings."

I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

K. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

L. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction as follows:

1. By bending.

F. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

K. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exterior Railings: SSPC-SP 6/NACE No. 3.
2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
3. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
4. Other Railings: SSPC-SP 3.

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

G. Shop-Painted Finish: Comply with Section 099600 "High-Performance Coatings."

1. Color: As selected by Architect from manufacturer's full range.

H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.2 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets**,** except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
4. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads.
5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

C. Install railing gates level, plumb, and secure for full opening without interference.

D. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055213

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SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior post-supported railings with glass-infill panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Metal railings assembled from standard components.
2. Glass products.
3. Fasteners.
4. Wood rails.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass and glass edge required.
3. Fittings and brackets.

D. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Glazed decorative metal railing manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Glacier Panel Railing System as manufactured by AGS Stainless, Inc., Clearview Railing Systems. info@agsstainless.com, 888-842-9492, Bainbridge, Washington.
1. Side Mount – 42” guardrail.
2. Stem Reducer
3. Wood Top Handrail

B. Product Options: Information on Drawings and in the Specifications establishes requirements for railing system's aesthetic effects and performance characteristics.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed decorative metal railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Glass-Infill Panels:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 STAINLESS STEEL

A. Tubing: ASTM A554, MT 316.

B. Pipe: ASTM A312/A312M, Grade TP 316.

C. Castings: ASTM A743/A743M, Grade CF 8M or Grade CF 3M.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A666 or ASTM A240/A240M, Type 316.

E. Bars and Shapes: ASTM A276, Type 316.

2.5 GLASS AND GLAZING PRODUCTS, GENERAL

A. Safety Glazing: Glazing is to comply with 16 CFR 1201, Category II.

B. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label is to indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Glazing Gaskets for Glass-Infill Panels: Glazing gaskets and related accessories as recommended or supplied by railing manufacturer for installing glass-infill panels in post-supported railings.

2.6 GLASS HANDRAILS AND GUARDS

A. Laminated Glass Handrails and Guards: ASTM C1172, Type II with two plies of glass bonded together by an interlayer.

1. Construction: Laminate glass with polyvinyl butyral interlayer or ionoplast polymer interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: to comply with interlayer manufacturer's written instructions for type of use.
3. Kind: LHS (laminated heat strengthened).
4. Glass Color: Inner-ply clear.
5. Interlayer Color: Clear.
6. Glass Plies for Glass-Infill Panels: Thickness required by structural loads, but not less than 5.0 mm each.

2.7 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Stainless Steel Components: Type 316 stainless steel fasteners.
   2. Dissimilar Metals: Type 316 stainless steel fasteners.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593, and nuts; ASTM F594 (ASTM F836M).

2.8 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel, center of rail 3-1/8 inches from face of balusters.

B. Wood Rails: Clear, straight-grained hardwood rails secured to metal subrail per manufactures' design.

   1. Species: Select White Maple.
   2. Finish: Transparent polyurethane.
   3. Staining: Match Architect's sample for interior woodwork and cabinetry.

2.9 FABRICATION OF METAL RAILINGS

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

C. Form changes in direction by inserting prefabricated elbow fittings.

D. Close exposed ends of hollow railing members with prefabricated end fittings.

E. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.

2.10 FABRICATION OF GLASS PANELS AND BALUSTERS

A. Fabricate glass to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

B. Glass-Infill Panels: Provide laminated, heat-strengthened glass-infill panels.

1. Edge Finish**:** Clean-cut or flat-grind edges to produce smooth, square edges with slight chamfers at junctions of edges and faces.

2.11 STAINLESS STEEL FINISHES

A. Stainless Steel Tubing Finishes:

1. Uniform, directionally textured finish.

B. Stainless Steel Sheet, Strip, Plate, and Bar Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.

B. Perform cutting, drilling, and fitting required for installing metal railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
3. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
4. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.2 INSTALLATION OF GLASS BALUSTERS

A. Post-Supported Railings with Glass-Infill Panels:

1. Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles.
2. Erect posts and other metal railing components and set factory-cut glass-infill panels.
3. Do not cut, drill, or alter glass-infill panels in field. Protect edges from damage.

END OF SECTION 057313

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SECTION 060312 - HISTORIC WOOD REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes historic treatment of wood in the form of repairing wood features as follows:

1. Repairing wood paneling, railings and trim.
2. Replacing wood paneling, railings and trim.
3. Repairing, refinishing, and replacing hardware.

B. Related Requirements:

1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to historic wood repair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing or attaching wood members to other surfaces, accessory items, and finishes.

C. Samples: For each type of exposed wood and finish.

1.5 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic wood-repair specialist, experienced in repairing, refinishing, and replacing wood in whole and in part. Experience only in fabricating and installing new woodwork is insufficient experience for wood historic treatment work.

B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation, Project-site inspection, and on-site assistance.

PART 2 - PRODUCTS

2.1 HISTORIC WOOD REPAIR, GENERAL

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

2.2 WOOD-REPLACEMENT MATERIALS

A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.

B. Exterior Trim: Match existing species.

C. Interior Trim: Match existing species.

2.3 WOOD-REPAIR MATERIALS

A. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

B. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated,

tooling time required for the detail of work, and site conditions. Compound must be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound must be capable of filling deep holes and spreading to featheredge.

2.4 HARDWARE

A. Hardware, General: Provide hardware required for each type of replicated or repaired wood, including, but not limited to, hinges, pulls, latches, fasteners, and accessories indicated or required for proper operation. Hardware must smoothly operate, tightly close, and secure units appropriately for frequency of use, unit weight, and dimensions.

B. Replacement Hardware: Replace existing damaged or missing hardware with new hardware.

C. Material and Design:

1. Material: Solid bronze of alloy indicated to match existing unless otherwise indicated.
2. Design: Match type and appearance of existing hardware.

D. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated.

2.5 MISCELLANEOUS MATERIALS

A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage caused by fungi and wood-boring insects; complying with AWPA P5; containing no boric acid.

B. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.

D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are the existing fastening method.

4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

2.6 WOOD FINISHES

A. Factory-Primed Replacement Units: Manufacturer's standard factory-prime coat on exposed exterior and interior wood surfaces; compatible with indicated finish coating.

B. Factory-Finished Units: Alkyd finish system consisting of primer and two finish coats on exposed exterior and interior wood surfaces.

1. Finish Coats: Manufacturer's standard.
2. Color and Gloss: Match colors indicated on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean wood of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

B. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC WOOD REPAIR, GENERAL

A. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Remove coatings and apply borate preservative treatment before repair. Remove coatings in accordance with Section 099124 "Interior Painting (MPI Standards)" unless otherwise indicated.
3. Repair items in place where possible.
4. Install temporary protective measures to protect wood-treatment work that is indicated to be completed later.
5. Refinish historic wood in accordance with Section 099124 "Interior Painting (MPI Standards)" unless otherwise indicated.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade

wood substrate, reducing clarity of detail. Do not use abrasive methods, such as sanding, wire brushing, or power tools, except as approved by Architect.

C. Repair and Refinish Existing Hardware: Dismantle hardware; strip paint, repair, and refinish it to match finish samples; and lubricate moving parts just enough to function smoothly.

D. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood by limited replacement matching existing material.

E. Replace Wood: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.

F. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location.

3.3 WOOD PATCH-TYPE REPAIR

A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.

1. Remove rotted or decayed wood down to sound wood.

B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood.

C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
3. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

3.4 WOOD-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood items at locations indicated on Drawings and where damage is too extensive to patch.

1. Remove broken, rotted, and decayed wood down to sound wood.
2. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.

3. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.

B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.

C. Repair remaining depressions, holes, or similar voids with patch-type repairs.

D. Reinstall items removed for repair into original locations.

END OF SECTION 060312

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of process and factory-fabricated product.
2. For preservative-treated wood products.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry unless otherwise indicated.
1. Concealed blocking.
2. Roof construction.
3. Plywood backing panels.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.6 METAL FRAMING ANCHORS

A. Allowable design loads, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

B. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

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SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof sheathing.
2. Parapet sheathing.
3. Subflooring.
4. Underlayment.
5. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 PARAPET SHEATHING

A. Glass-Mat Gypsum Sheathing, Parapets: ASTM C1177/C1177M.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm)] thick.

2.2 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1

1. Match thickness of existing Subfloor-Underlayment.

B. Plywood Subflooring: DOC PS 1 single-floor panels or sheathing.

C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

1. Plywood Underlayment for Carpet: DOC PS 1 Interior, Underlayment.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to fiberglass composite metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

END OF SECTION 061600

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SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior wood trim.

1.3 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each exposed product and for each color and texture specified.

C. Manufacturer's Warranty for Engineered Wood Siding Trim: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Factory-Applied Finish: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece**,** or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

2.2 EXTERIOR TRIM

A. Lumber Trim for Painted Finish:

1. Western red cedar; NLGA, WCLIB, or WWPA Grade B.
2. Hem-fir; NLGA, WCLIB, or WWPA 1 Common.
3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
4. Finger Jointing: Not allowed.
5. Face Surface: Surfaced (smooth).
6. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.

B. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Molding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Finger Jointing: Allowed if made with wet-use adhesive complying with ASTM D5572.
3. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.

C. MDO Trim: Exterior Grade B-B MDO plywood.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails unless otherwise indicated.
2. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
3. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
4. For applications not otherwise indicated, provide hot-dip galvanized-steel or aluminum fasteners.

B. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

C. Sealants: Latex, complying with ASTM C834 Type OP, Grade NF and applicable requirements in Section 079200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.

1. Cut to required lengths and prime ends.
2. Comply with requirements in Section 099113 "Exterior Painting."

3.2 INSTALLATION, GENERAL

A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.3 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install flat-grain lumber with bark side exposed to weather.

B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water.

1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

END OF SECTION 062013

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior trim, including non-fire-rated interior door frames.

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

C. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece**,** or omit grade stamp and provide certificates of grade compliance issued by grading agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

D. MDF: ANSI A208.2, Grade 130.

E. Particleboard: ANSI A208.1, Grade M-2.

2.2 INTERIOR TRIM

A. Moldings for Opaque Finish (Painted Finish): Made to match existing.

1. Softwood Moldings: MMPA WM 4, P grade.

a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

2. Hardwood Moldings: MMPA WM 4, P-grade.

a. Species: Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar.
b. Maximum Moisture Content: 9 percent.

3. Finger Jointing: Allowed.

2.3 PANELING

A. Hardboard Paneling: Interior factory-finished hardboard paneling complying with ANSI A135.5.

1. Thickness: Match existing.
2. Finish: Match existing.
3. Colors, Textures, and Patterns: Match Architect's samples and existing.

B. Board Paneling.

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Grade: Match existing.
3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
4. Pattern: Match existing.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.

D. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.3 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Install trim after gypsum-board joint finishing operations are completed.
7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
8. Fasten to prevent movement or warping.

9. Countersink fastener heads on exposed carpentry work and fill holes.

3.4 INSTALLATION OF PANELING

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.

1. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings.
2. Install with uniform tight joints between panels.
3. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
4. Space fasteners and adhesive as recommended by panel manufacturer.
5. Conceal fasteners to greatest practical extent.
6. Arrange panels with grooves and joints over supports.

    a. Fasten to supports with nails of type and at spacing recommended by panel manufacturer.
    b. Use fasteners with prefinished heads matching groove color.

B. Hardboard Paneling: Install according to manufacturer's written instructions.

1. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings.
2. Butt adjacent panels with moderate contact.
3. Use fasteners with prefinished heads matching paneling color.
4. Plaster or Gypsum-Board Substrate: Install with 1-5/8-inch annular-ring shank hardboard nails.
5. Nailing: Space nails 4 inches o.c. at panel perimeter and 8 inches o.c. at intermediate supports unless otherwise required by manufacturer.

C. Board Paneling: Install according to manufacturer's written instructions.

1. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
2. Install in full lengths without end joints.
3. Stagger end joints in random pattern to uniformly distribute joints on each wall.
4. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.
5. Install with uniform end joints. Locate end joints only over furring or blocking.
6. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards.
7. Install with uniform tight joints between boards.
8. Fasten paneling by face nailing, setting nails, and filling over nail heads.

END OF SECTION 062023

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Research reports.

C. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Architectural Woodwork Standards Grade: Custom.

B. Type of Construction: Frameless.

C. Door and Drawer-Front Style: Reveal overlay.

1. Reveal Dimension: 1/4 inch or as indicated.

D. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

E. Exposed Surfaces:

1. Plastic-Laminate Grade: HGS.
2. Edges: ABS/PVC extruded fabrication
3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels unless indicated otherwise.

F. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As scheduled on Woodwork Finish Legend.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1**,** medium-density overlay.
2. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid stainless steel, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.

a. Type: Full extension.
b. Material: Galvanized steel ball bearing slides.

c. Motion Feature: Soft-close mechanism.

G. Door Locks: ANSI/BHMA A156.11, E07121.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Stainless Steel: ANSI/BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

D. Roll out shelf: To match drawer construction.

2.5 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with [No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

END OF SECTION 064116

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SECTION 066100 – GLASS FIBER REINFORCED PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Glass fiber reinforced plastic fabrications as indicated on the drawing

1.4 RELATED SECTIONS

A. Section 055000 - Metal Fabrications: Supplementary supports for large items..

B. Section 061000 - Rough Carpentry: Supplementary supports for large items.

C. Section 099600 – High-Performance Coatings: Field painting and sealing prior to painting.

1.3 REFERENCES

A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 1999.

B. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 1998c.

C. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 1999.

D. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics; 1996.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.

1.5 ACTION SUBMITTALS

A. Product Data: Product Data: Manufacturer's data sheets on each product to be used, including dimensions, finishes, storage and handling requirements and recommendations, and installation recommendations.

B. Shop Drawings: For custom items, provide drawings showing dimensions, layout, joints, details, and interface with adjacent work; include field measured dimensions of the spaces where items are to be installed, if critical to proper installation.

C. Samples: For each custom finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design Manufacturer: Stromberg Architectural Products Inc; PO Box 8036, I-30 West, 4400 Oneal, Greenville, TX 75404. ASD. Tel: (903) 454-0904. Fax: (903) 454-3642. Email: sales@strombergarchitectural.com. www.strombergarchitectural.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 012500.

2.2 MATERIALS

1. Glass Fiber Reinforced Plastic Fabrications: Molded surface coat over polyester resin laminate reinforced with glass fiber and structural reinforcing as required.
   a. Surface Coat: Ultraviolet inhibited NPG-ISO polyester gel coat, 20 mils (0.5 mm) thick, nominal.
   b. Surface Coat: Polyurethane.
   c. Color: Cream to match existing limestone as approved by architect.
   d. Texture on Exposed Side: Smooth.

e. Resin: Isophthalic polyester resin; with flame spread index less than 25, smoke developed index less than 450, when tested in accordance with ASTM E 84; heat distortion greater than 180 degrees F (82 degrees C), when tested in accordance with ASTM D 648.
f. Glass Fiber: "E" type random chopped fibers.
g. Glass Content: 25 to 30 percent by weight.
h. Glass Content: 15 percent by weight, maximum.
i. Shell Thickness: 3/16 inch (5 mm), minimum.
j. Surface Burning Characteristics: Flame spread index of less than 25, smoke developed index of less than 450,when tested in accordance with ASTM E 84.
k. Flexural Strength: 20000 psi (138 MPa), when tested in accordance with ASTM D 790.
l. Modulus of Elasticity: 0.9 x 10^6 psi (6200 MPa), when tested in accordance with ASTM D 790.
m. Tensile Strength: 12000 psi (83 MPa), when tested in accordance with ASTM D 638.
n. Compressive Strength: 17000 psi (117 MPa), when tested in accordance with ASTM D 695.
o. Bearing Strength: 9000 psi (62 MPa), when tested in accordance with ASTM D 638.
p. Thermal Expansion Coefficient: 10 x 10^-6 per degree F (5.56 x 10^-6 per degree C).
q. Specific Gravity: 1.5.
r. Variation in Thickness From Nominal: Minus 1/16 inch (1.5 mm), plus 1/4 inch (6 mm).
s. Variation in Thickness of Gel Coat: Plus and minus 2.5 mils (0.06 mm), maximum.
t. Variation from Dimensions Indicated on Drawings: Plus and minus 1/8 inch (3 mm), maximum.
u. Variation from Square: Plus and minus 1/8 inch (3 mm), maximum.
v. Variation of Hardware From Intended Location: Plus and minus 1/4 inch (6 mm), maximum.
w. Provide concealed reinforced anchorage points for anchors of type recommended by manufacturer.
x. Mark each unit with permanent serial number coordinated with shop drawing designators.
y. Cure and clean prior to shipment; remove material that may be toxic to plant or animal life or incompatible with adjacent building materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect and wait for instructions before beginning installation.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install supplementary temporary and permanent supports as required for proper installation.

3.3 INSTALLATION

A. Install in accordance with applicable code and manufacturer's recommendations, plumb and true to line; shim where necessary.

B. Install with variation from position shown on drawings not more than 1/4 inch in 10 feet (6.25 mm in 3 m); align horizontal and vertical joints.

C. Fasten using methods that allow for thermal expansion and contraction.

D. Provide control joints at not more than 35 feet (10.5 m) on center if not indicated on drawings.

E. Provide expansion joints where moving joints in substrate occur.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 066100

SECTION 070543.11 - COMPOSITE METAL HYBRID (CMH) CONTINUOUS INSULATION CLADDING SUPPORT SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Composite metal hybrid (CMH) sub-framing support system with in-fill continuous insulation integrated within metal wall panels or exterior wall cladding.

1. Substrate: Concrete masonry units (CMU).

1.02 RELATED REQUIREMENTS

A. Section 042000 – Unit Masonry: Concrete masonry unit (CMU) wall substrate.

B. Section 054000 – Cold-Formed Metal Framing: Metal stud substrate support framing.

C. Section 061000 – Rough Carpentry: Exterior sheathing and wood stud substrate support framing.

D. Section 072726 – Fluid-Applied Membrane Air Barriers.

E. Section 074213.23 – Metal Composit Material Wall Panels.

F. Section 079200 – Joint Sealants: Perimeter sealant.

G. Section 092900 – Gypsum Board.

1.03 REFERENCE STANDARDS

A. ASCE American Society of Civil Engineers (www.asce.org).

1. ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2022.
2. ASCE – Structural Plastics Design Manual.

B. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.org).

1. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019.
2. ASHRAE 189.1 – Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings; 2020.

C. ASTM International – American Society for Testing and Materials (www.astm.org).

1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zing-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2022.
2. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

3. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (2019).
4. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (2019).
5. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
6. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
7. ASTM C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2019.
8. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2017 (2022).
9. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.
10. ASTM D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics; 2017.
11. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010(2018).
12. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
13. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 2022.
14. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
15. ASTM D638 – Standard Test Method for Tensile Properties of Plastics; 2022.
16. ASTM D696 – Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between minus 30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer; 2016.
17. ASTM D7332-B – Standard Test Method for Measuring the Fastener Pull-Through Resistance of a Fiber-Reinforced Polymer Matrix Composite; 2022.
18. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
19. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2020.
20. ASTM D4385 – Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2019.
21. ASTM D6641/D6641M – Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials Using a Combined Loading Compression (CLC) Test Fixture; 2016e2.
22. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.
23. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a.
24. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
25. ASTM E330/E330M – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (2021).

26. ASTM E2178 – Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

D. IBC – International Building Code (ICC – International Code Council); 2021.

E. IECC – International Energy Conservation Code; 2021.

F. IgCC – International Green Construction Code; 2021.

G. NFPA – National Fire Protection Association (www.nfpa.org).

1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

H. Voluntary Product Standard; Department of Commerce (DOC) and National Institute of Standards and Technology (NIST) (www.apawood.org).

1. PS 1 – Structural Plywood; 2019 (Revised 2020).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate installation of continuous insulation sub-framing support system as indicated on drawings for proper drainage, flashing, trim, backup support, soffits, and other related Work.
1. Review and finalize construction schedule.
2. Verify availability of materials, installer's personnel, equipment, and facilities needed to meet established schedule.
3. Review means and methods related to installation in accordance with manufacturer's installation instructions.
4. Examine support conditions for compliance with installation requirements, including alignment and attachment to structural support system.
5. Review flashings, wall cladding details, wall penetrations, drainage plane, openings, and condition of other construction that is related to this Work.
6. Review temporary protection requirements for during and after installation of this Work.

1.05 SUBMITTALS

A. See Section 013300 –Submittal Procedures.

B. Product Data: Submit for each product being used as indicated, including installation details, material descriptions, dimensions of individual components and profiles, and necessary accessories for a complete assembled system.

C. Test and Engineering Reports: Submit Test and Engineering reports on each type of composite sub-framing system based on the evaluation of comprehensive tests performed by a certified testing agency and/or Professional Engineers (PE) approved by authorities having jurisdiction.
1. Structural Composite Sub-Framing Submittal:

Provide PE stamped calculations for the composite sub-framing system carrying the associated cladding system that takes into account:

a. Anisotropic properties of the sub-framing.
b. Point loading of the fasteners and representative dynamics of the cladding system.
c. Uniform loading calculations not being allowed as it is not representative to actual wall systems.
d. Calculations for eccentric cantilever conditions.
e. Calculations providing a safety factor minimum of 4 at the high service temperature of 180 degrees Fahrenheit.
f. Fastener Creep and Durability Test for FRP sub-girts, certified by third party/PE. Test to be completed per reference section 2.03E.
g. Fire: ASTM E84 Class A and NFPA 285 tested for the specific wall assembly in this project.

D. Warranty: Submit manufacturer's sample warranty and ensure forms have been completed in Owner's name, registered with manufacturer for the Manufacturer's Warranty for the Sub-Framing System, and FRP Manufacturer's Warranty for Screw Creep and Durability per section 1.09.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years of documented experience.
   1. Engineering Review: Manufacturer to provide Technical Engineering Report (TER) based on CMH support system and cladding system design.
   2. Code Conformance: CMH system to have been evaluated by IAPMO Uniform Evaluation Service and found satisfactory for compliance with 2021 International Building Code.

B. Installer Qualifications: Company specializing in performing work as indicated in this section with at least three years of documented experience and approved by manufacturer.
   1. Install system in strict compliance with manufacturer's installation instructions.

C. Design Engineer's Qualification: Design structural supports and anchorages under direct supervision of a licensed Structural Engineer experienced in design for this type of Work and licensed in State that Project is located. Engineering information provided shall be signed and verified by licensed Structural Engineer.

D. Environmental: CMH system to follow the below guidelines:
   1. CMH system to be registered as red list chemical free with the Declare label.
   2. The components shall be certified to be halogen/bromine free.
   3. CMH composite member shall utilize a minimum of 25% post-consumer recycled material content.
   4. Environmental Product Declaration: CMH Manufacturer shall provide a product-specific EPD Type III report in accordance with EN 15804 and ISO 14025.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 – Construction Waste Management and Disposal for material waste requirements.

B. Deliver materials to site without damage or deformation in manufacturer's original unopened containers and with labels that clearly identify product name and manufacturer.

C. Storage: Store materials in clean, dry, and level interior or exterior areas for limited duration in accordance with manufacturer's written instructions.

D. Protect components during transportation, handling, and installation from moisture, excessive temperatures, and other construction operations in accordance with manufacturer's written instructions.

E. Handle components in accordance with manufacturer's written instructions and in a manner to prevent bending, warping, twisting, and surface, edge, or corner damage.

1.08 SITE CONDITIONS

A. Weather Limitations: Only proceed with installation when existing and forecasted weather conditions allow for assembly of this Work in accordance with manufacturer's written installation instructions.

1.09 WARRANTY

A. See Section 017700 – Closeout Procedures for additional warranty requirements.

B. Manufacturer's Warranty for the Sub-Framing System: Provide five (5)-year manufacturer's warranty for composite metal hybrid (CMH) sub-framing support system commencing on the date of manufacture or date of substantial completion.

C. FRP Manufacturer's Warranty for Screw Creep and Durability: Provide 20-year manufacturer's non-prorated, product replacement warranty against fastener creep and/or decreased fastener retention capacity for cladding fasteners that are anchored solely into an FRP substrate in lieu of a metal substrate. FRP material to be warrantied to perform long term to retain fasteners in a load capacity equivalent to 16 Ga. steel under the same loading, temperature, duration, and durability.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Advanced Architectural Products (A2P):
   1. Address: 959 Industrial Drive, Allegan, Michigan 49010.
   2. Phone: (269) 355-1818; Fax: (866) 858-5568; Website: GreenGirt.com.

B. Products:

1. Basis of design;
    i. SMARTci 1 in 1 System.
2. Other products shall be pre-submitted and approved products that meet materials and performance requirements with specified and validated third-party testing.

2.02 DESCRIPTION

A. Attach CMH sub-framing support system components to concrete masonry units (CMU) as indicated on drawings.

1. See Section 042000 for CMU substrate.
2. See Section 054000 for metal stud framing.
3. See Section 074213.23 for wall panels system.

B. Install CMH sub-framing support system components horizontally onto masonry substrate system as indicated on drawings in compliance with project requirements.

2.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide system tested in accordance with ASTM E330/E330M and certified to be without permanent deformation or failure of structural members in accordance with design wind velocities for project location and potential for occurrence based on data from wind velocity maps and other provisions of ASCE 7 and as approved by authorities having jurisdiction (AHJ).

1. Provide finite element analysis (FEA) to model and evaluate areas of the longest composite girt cantilever span possible between intermediate framing members/attachment.

    a. FEA shall include maximum dead load and wind load conditions.
    b. FEA shall include point loads representative of fastener locations.
    c. Maximum directional stresses in model shall have a safety factor of 4 or greater.
    d. Stresses shall be indicated and analyzed in 3 directions.
    e. FEA shall accurately replicate the wall system and physical loading dynamics.
    f. Report shall be furnished with the submittal.

2. Butt joints (non-interlocking joints) of adjacent girts shall be installed on a minimum surface width of 3" or double stud condition to accommodate proper fastener margins to composite.

B. System Thermal Design: Ensure that installed continuous insulation and CMH sub-framing support system, and cladding attachment does not have thermal bridging of fasteners or framing

that creates a continuous metal path from exterior surface of insulation to interior face of insulation.

1. Verify that system thermal design meets or exceeds thermal design requirements in accordance with IgCC energy code.

2. Thermal Performance Test: Provide thermal resistance (R-value) indicated, in accordance with ASTM C1363, corrected to 15 mph wind outside and still air inside, with installed condition including fasteners and joints.

3. Provide efficiency of no less than 93 to 98 percent, with a maximum temperature differential of 18 degrees F from interior wall surface to interior wall cavity and node locations with a 70 degrees F exterior to interior wall temperature delta.

4. Provide test unit with at least one insulation panel horizontal and vertical joint length and height of test chamber area.

5. Provide finite element analysis of three-dimensional simulation of described wall assembly sealed by a professional engineer in compliance with code performance requirements and exceeding it by at least 3 percent.

C. Temperature Range: Comply with structural loading requirements within a temperature range of minus 55 degrees F to 180 degrees F.

D. Fastener Creep and Durability Test: For fasteners anchored into an FRP substrate without metal backer/retention system, perform per ASTM D7332-B, seven (7) day continuous fastener loading at the project's specified high service temperature of 180 degrees F.
   1. The fastener thread pull-out test is to be performed for self-drilling screws anchored solely into an FRP substrate. Test with ASTM D7332-B fixture using a fixture with a clearance opening of 34mm (1.313") in diameter. The pulling yoke is to be attached to the fastener head, with the load transferring into the anchoring threads. Ramp loading for no less than 30 seconds and no more than 120 seconds.
   2. Testing to be performed inside a climate chamber at a temperature of 180 degrees F for a period of 7 days at ultimate fastener load. Passing load values to be considered ultimate pull-out values for project engineering purposes.
   3. Test for 5 samples at same loading and temperature without pull-out. Testing to be certified by independent 3rd party.
   4. Test results of fastener head/thread pull-through performed at room temperature with static ASTM D7332-B are not considered valid for creep and durability testing and are not to be used for determining ultimate screw loading values.

2.04 COMPOSITE METAL HYBRID (CMH) SUB-FRAMING SUPPORT SYSTEM

A. CMH Sub-Framing Support System: Provide CMH sub-framing support system with recycled materials, fire retardant additives, and integral continuous metal inserts the length of the profile. Reinforce CMH sub-framing support system with glass strand rovings used internally for

longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.

1. Length of CMH Support System: 96 inches standard length.

2. Depth of CMH Support System: 2” and 2-1/2 inches deep.

3. Grid Spacing of CMH Sub-Framing Supports for Substrate Attachments; Horizontally or Vertically:
    a. Horizontal Spacing: 24 inches on center.
    b. Vertical Spacing: As required for Composit Metal Panel installation or maximum 24 inches on center.

4. Fastener Retention System: Provide continuous galvanized steel insert for engagement of fasteners, at least 16-gauge thick, with G90 galvanized coating in accordance with ASTM A653/A653M.
    a. Fasten CMH sub-framing support and other wall cladding support accessories through steel insert located within top and bottom of CMH sub-framing.
    b. Provide screw pull-out testing that meets or exceeds manufacturer’s requirements.
    c. Provide at least 3-inch overlap of metal inserts between CMH supports with 3/16 inch wide gap; sealant is not required.

5. Provide integral 3-point compression seal within CMH sub-framing to ensure insulation will not dislodge.

6. Provide integral anti-siphon grooves on exterior and interior flanges of CMH sub-framing.

7. Provide force distribution zones integrally designed into profile of CMH sub-framing.

8. CMH sub-framing is self-extinguishing in accordance with ASTM D635.

9. Visual defects in CMH sub-framing are classified in accordance with ASTM D4385.

10. Tensile Properties: Engineered lengthwise and crosswise tensile properties of CMH sub-framing comply with performance loading criteria and specified safety factors in accordance with ASTM D638.
    a. Lengthwise 50,000 psi and crosswise 40,000 psi, minimum.

11. Compressive Properties: Engineered lengthwise and crosswise compressive properties of CMH sub-framing comply with performance loading criteria and specified safety factors in accordance with ASTM D6641/D6641/D6641M.
    a. Lengthwise 50,000 psi and crosswise 40,000 psi, minimum.

12. Flexural Properties: Engineered lengthwise and crosswise flexural properties of CMH sub-framing comply with performance loading criteria and specified safety factors in accordance with ASTM D790.
    a. Lengthwise 50,000 psi and crosswise 40,000 psi, minimum.

13. Modulus of Elasticity: CMH sub-framing is engineered to meet performance loading criteria and specified safety factors in accordance with ASTM D638.
    a. Lengthwise 29,000,000 psi and crosswise 3,300,000 psi, minimum.

14. Water Absorption: CMH sub-framing absorbs less than 0.46 percent by weight within 24 hours when tested in accordance with ASTM D570.

15. Relative Density: CMH sub-framing is within range of 0.062 to 0.070 lbs/cubic inch when tested in accordance with ASTM D792.

16. Coefficient of Linear Thermal Expansion: CMH sub-framing is at 7.0 x 10^{-6} inch/inch/degrees F when tested in accordance with ASTM D696.

17. Notched Izod Pendulum Impact Resistance, Lengthwise: CMH sub-framing is at 160 ft lbs/inch when tested in accordance with ASTM D256 within standard temperature range.

18. Notched Izod Pendulum Impact Resistance, Crosswise: CMH sub-framing is at 100 ft lbs/inch when tested in accordance with ASTM D256 within standard temperature range.

19. Barcol Hardness: 45, in accordance with ASTM D2583.

20. Thermal Transmission: CMH sub-framing support system design should limit rate of heat flow crosswise through the profile section to less than 1.785W watts per 8' length in profile and temperature delta of 100 degrees Fahrenheit. Rate of heat flow to be determined in accordance with ASTM C1045-01, validated by a third party.

    REFERENCE CHART

Profile Depth	Rate of heat flow (watts)
1.5″	2.380W
2″	1.785W
2.5″	1.428W
3″	1.190W
3.5″	1.020W
4″	0.892W
4.5″	0.793W
5″	0.714W
5.5″	0.649W
6″	0.595W

2.06 COMPOSITE METAL HYBRID (CMH) TRIM

A. CMH Trim: Provide nonstructural trim at rough openings to properly transition continuous insulation (CI) system.
   1. Use angled and flat trim to enclose CI system and to provide thermally broken transitions within wall assemblies.
      a. Angled Trim: 2 by 3 inches or As indicated on drawings.
      b. Flat Trim: 6 inches and/or 12 inches wide, or As indicated on drawings.
   2. Use sealant and tapes as required to transition weather-resistive barriers (WRB) from substrate onto trim.
   3. Trim to provide 90-degree transition of CI substrate for weather-resistive barriers (WRB) and exterior flashing.
   4. Cover trim with exterior panel assembly and flashings.
   5. Surface Burning Characteristics:
      a. Flame Spread Index (FSI): 25 or less when tested in accordance with ASTM E84.
      b. Smoke Developed Index (SDI): 450 or less when tested in accordance with ASTM E84.
   6. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly, tested in accordance with NFPA 285.
   7. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
   8. Acceptable Products:
      a. SMARTci Trim
      b. Alternative: Performance CI system utilizing metal trim to provide spray foam insulation at a depth of 6" extending 32" around openings to reduce thermal transfer at wall transitions.

2.07 ASSEMBLY

A. Assembly CMH sub-framing support system in accordance with manufacturer's installation instructions and as necessary to comply with performance requirements indicated.
   1. Comply with CMH sub-framing support system dimensional and structural requirements as indicated on drawings.
   2. Install CMH sub-framing support system in acceptable sequence in accordance with manufacturer's written installation instructions.
   3. Install spray foam sealant on backside of cantilevered fasteners that completely puncture insulation layer.
   4. Provide uninterrupted, monolithic drainage plane as required per project details.

2.08 ACCESSORIES

A. Provide necessary accessories for complete installation of CMH sub-framing support system including transition angle, strapping, tie-in brackets, and other similar items.

B. Fasteners: Corrosion-resistant, self-tapping, and self-drilling screws, bolts, nuts, and other fasteners as recommended by CMH sub-framing support system manufacturer for CMH materials and other project applications.
   1. Cladding to CMH: Use standard self-tapping metal screws.
   2. CMH to Metal Stud Wall Framing: Use standard self-tapping metal screws.
   3. CMH to Concrete or Concrete Masonry Units (CMU): Use standard masonry or concrete screw anchors in pre-drilled hole.
   4. CMH to Wood Stud Wall Framing: Use standard wood screw anchors.
   5. Use of powder, air, or gas-actuated fasteners or actuated fastener tools is not permitted.
   6. Use of impact wrenches when fastening to or from CMH is not permitted.

   7. CMH attachments to follow guidelines of ASCE Structural Plastics Design Manual:

	Ratio of distance to fastener diameter
	Minimum Distance Allowable
Edge distance- end	3.0
Edge distance- side	2.0

C. Wall Sheathing: Gypsum board; V-shaped long edges and Type X fire-resistant in accordance with ASTM C1396/C1396M.
   1. Refer to drawings for thickness and see [Section 06 1000] or [Section 09 2116] for additional requirements.

D. Closure and Transition Accessories (if necessary): Use FRP angles and flat stock per standard system details.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, CMH sub-framing support system conditions, and other conditions affecting performance of this Work.

B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances in accordance with installation instructions of CMH sub-framing support system manufacturer.

C. Examine components and systems penetrating CMH sub-framing support system prior to installation during rough-in stage of construction to coordinate actual locations of penetrations relative to CMH sub-framing support system's joint locations.

D. Verify that mechanical and electrical-related installations for exterior walls have been completed and verify that adjacent materials and finishes are dry and ready for insulation installation.

E. Proceed with installation of CMH sub-framing support system only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare substrate surfaces using methods recommended in writing by CMH sub-framing support system manufacturer to achieve excellent results under project conditions.

C. Prepare sub-framing, base angles, sills, furring, and other CMH sub-framing support system components and provide anchorage in accordance with ASTM C754 for substrate and wall cladding types in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install CMH sub-framing support system in accordance with manufacturer's installation instructions.

B. Install CMH sub-framing support system to meet requirements of ASCE Structural Plastics Design Manual.

C. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.

D. Trim insulation neatly to fit spaces and insulate miscellaneous gaps and voids.

E. Seal gaps, voids or penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.

F. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.

G. Exposed insulation must be protected from open flame and kept dry at all times.

H. Exterior wall insulation panels are not intended to be left exposed for periods of time to excess of 60 days without adequate protection.
    1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, windows and door openings with a compatible waterproof tape.

I. Install CMH sub-framing support system in compliance with system orientation, sizes, and locations as indicated on drawings.

3.04 TOLERANCES

A. Shim and align CMH sub-framing support system with installation tolerances of ¼ inch in 20 feet, non-cumulative, level, plumb, and aligned with locations as indicated on drawings.

3.05 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Ensure that insulation panels are not exposed to moisture.

    1. Remove wet insulation panels or allow them to completely dry prior to installation within CMH sub-framing support system.

C. Replace damaged insulation prior to Date of Substantial Completion.

END OF DOCUMENT 070543.21

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. VOC Content: Products are to comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.3 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.

D. Extruded-polystyrene drainable board insulation, unfaced, ASTM C578, Type X, 2 inch thick.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing.

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Insure all loose materials are removed from existing foundation walls and surface is prepared to manufacturer’s requirements.

3.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1.5 gal./100 sq. ft. for second coat.

B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1.5 gal./100 sq. ft. for second coat.

C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.3 PROTECTION COURSE INSTALLATION

A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

END OF SECTION 071113

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Mineral-wool blanket insulation.
3. Mineral-wool board insulation.
4. Glass Fiber Batt insulation.

1.3 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

D. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings.

E. Low VOC: Products used within the building envelope to meet CDPH/EHLB Method V.1.1 requirements for Office.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

2.4 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Acoustical Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E84 for combustion characteristics.

2.5 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation, Type IVB: ASTM C612, Type IVB; unfaced.

1. Nominal Density: 6.2 lb/cu. ft. outer layer and 3.8 lb/cu. ft. inner layer.

2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.7 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
4. Tapes for Reflective Insulation and Barriers:

    a. Aluminum-foil tape for repairs or splicing material.
    b. Double-sided tape for adhering to metal framing or overlapping material.
    c. Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.

5. Clip-and-Pin Components:

    a. Beam/Bar Joist Clips: For beams, bar joists, and Z-type purlins.
    b. C-Purlin Clips: For C-type purlins.
    c. Angle Clips: For sidewalks and floors.
    d. Tube Clips: For wood beams and metal tubular framing.
    e. Locking Washers: Aluminum; white to match reflective bubble insulation facing colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

C. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.

1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install unfaced blanket insulation over ceiling area in thickness indicated. Where partitions occur, extend insulation up either side of partition.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

B. Install interior radiation control coating system in accordance with ASTM C1321.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Vapor-permeable, fluid-applied air barriers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

   1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.5 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

    a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    b. Include junction with roofing membrane and foundation wall intersection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum Pass when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.02 L/s x sq. m of surface area at 75 Pa) pressure difference; ASTM E2178.

D. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested in accordance with ASTM D4541.

F. UV Resistance: Can be exposed to sunlight for 60 days in accordance with manufacturer's written instructions.

2.2 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. High-Build, Vapor-Permeable Air Barrier Synthetic Polymer Type: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

B. Vapor Permeance: Minimum 5 perms; ASTM E96/E96M, Desiccant Method, Procedure B, Water Method.

2.3 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars,

termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.2 INSTALLATION

A. Install materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames.

D. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

E. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.

F. Do not cover air barrier until it has been tested and inspected by testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: As determined by testing agency from among the following tests:

1. Air-barrier dry film thickness.
2. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

E. Prepare test and inspection reports.

3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

B. Remove masking materials after installation.

END OF DOCUMENT 072726

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SECTION 073126 - SLATE SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Slate shingles.
2. Underlayment materials.
3. Ridge accessories.
4. Metal flashing and trim.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Slate shingles.
2. Underlayment materials.
3. Ridge accessories.
4. Metal flashing and trim.

B. Shop Drawings: For metal flashing and trim.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Material test reports for slate.

B. Research reports for polymer-modified bitumen sheet underlayment and synthetic underlayment.

PART 2 - PRODUCTS

2.1 SLATE SHINGLES

A. Slate Shingles: ASTM C406/C406M, Grade S1; hard, dense, and sound; with chamfered edges and nail holes machine punched or drilled and countersunk; with no broken or cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

1. Thickness and Surface Texture: Match existing.
2. Length: Match existing
3. Width: Match existing.
4. Nail Holes: Match existing.
5. Butt Shape: Match existing.
6. Color: Match Architect's samples from existing roof.

B. Starter Slate: Slate shingles with chamfered nail holes front-side punched.

1. Length: Exposure of slate shingle plus headlap.

C. Ridge Slate: Match existing.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 40-mil-thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.
1. \

2.3 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

C. Roofing Asphalt: ASTM D312/D312M Type IV.

D. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.

E. Slating Nails: ASTM F1667, copper, smooth-shanked, wire nails; 0.135-inch- minimum thickness; sharp pointed; with 3/8-inch- minimum diameter flat head; of sufficient length to penetrate a minimum of 3/4 inch into sheathing or extend at least 1/8 through sheathing less than 3/4 inch thick.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

F. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch- minimum diameter.

G. Nails for Wood Strips: ASTM F1667; common or box, steel wire, flat head, and smooth shank; hot-dip galvanized.

2.4 METAL FLASHING AND TRIM

A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Sheet Metal: Copper.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item unless otherwise indicated on Drawings.

C. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLATE SHINGLES

A. Remove damages slates and those necessary for installation of new flashings. Install slate shingles in accordance with manufacturer's written instructions and with details and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" to match existing.

B. Match existing headlap between succeeding shingle courses.

C. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.

D. Hang slate with [**two**] [**four**] slating nails for each shingle, with nail heads lightly touching slate.

1. Do not drive nails home, which draws slates downward, and do not leave nail heads protruding enough to interfere with the overlapping shingle above.
2. At vented ridges, terminate slate shingles to produce a uniform airspace on each side of ridge apex.

E. Ridges: Install ridge slate in saddle configuration.

1. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip 3 to 4 inches from the eave. Cover with self-adhering,

polymer-modified bitumen sheet, extending to underlying slate but concealed by ridge slate.

2. Anchor ridge slate to supporting wood nailer strip with four nails for each slate shingle, without nails penetrating underlying slate.

F. Open Valleys: Cut slate shingles to form straight lines at open valleys, trimming upper concealed corners of shingles. Maintain uniform width of exposed open valley from highest to lowest point.

1. Do not nail shingles to valley metal flashings.

G. Remove and replace damaged or broken slate shingles.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

A. Comply with slate-shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

B. Polymer-Modified Bitumen Sheet: Install parallel with and starting at eaves.

1. Double-Layer Installation:

a. Install on roof deck in overlapping layers with a half-width plus 1-inch- wide starter course at eaves completely covered by full-width second course.
b. Install succeeding courses lapping previous courses by a half-width plus 1 inch in shingle fashion.
c. Lap ends a minimum of 6 inches.
d. Stagger end laps between succeeding courses at least 72 inches.
e. Fasten with underlayment nails.

2. Terminate sheets extended up not less than 4 inches against sidewalls, curbs, chimneys, and other roof projections.

C. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free.

1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water. Lap sides not less than 4 inches.
3. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
4. Roll laps with roller.
5. Prime concrete, masonry, and metal surfaces to receive self-adhering, polymer-modified bitumen sheet.
6. Single-Layer Installation: Install over entire roof deck.
7. Top-Layer Installation: Install as second layer over anchor-layer underlayment.

a. Completely cover anchor-layer underlayment.
b. Offset side laps halfway between side laps of underlying anchor layer and offset end laps from those of underlying anchor layer at least 72 inches.

8. Water and Ice-Dam Protection Installation: Install on roof deck where indicated on Drawings.

D. Valley Underlayment: Install one layer of 36-inch- wide underlayment centered in valley, running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.

1. Use same underlayment as installed on field of roof.
2. Lap ends at least 12 inches in direction that sheds water, and seal with asphalt roofing cement.
3. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.

3.3 INSTALLATION OF RIDGE ACCESSORIES

A. Rigid-Plastic Ridge Vents: Install continuous ridge vents in accordance with manufacturer's written instructions. Fasten with slating nails of sufficient length to penetrate sheathing.

3.4 INSTALLATION OF METAL FLASHING AND TRIM

A. Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Install metal flashings in accordance with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."

B. Pipe Flashings: Form flashing around pipe penetrations and slate shingles. Fasten and seal to slate shingles.

END OF DOCUMENT 073126

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SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes MCM wall panels.

1.3 DEFINITIONS

A. DBVR: Drained and back-ventilated rainscreen system; rainscreen system designed to drain and dry cavity entering water through drainage channels, weeps, and air ventilation.

B. MCM: MCM; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, MCM panel Fabricator and Installer, MCM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM panels.
5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
6. Review temporary protection requirements for MCM panel assembly during and after installation.
7. Review procedures for repair of panels damaged after installation.
8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of MCM panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. MCM Panels: 12 inches long by actual panel width. Include fasteners, closures, and other MCM panel accessories. Submit custom color samples in paint manufacturer's standard size.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
2. MCM System Fabricator's Certified System Tests Reports: Certified system test reports showing system compliance with specific performance or third-party listing documenting compliance code section. Base performance requirements on MCM system type provided.

a. Wet System: Tested to AAMA 501.
b. DBVR System: Tested to AAMA 509.
c. PER System: Tested to AAMA 508.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by MCM Fabricator.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Warranty on Panel Material: Manufacturer's standard form in which manufacturer agrees to replace MCM that fails within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Panel Deflection Limit: For wind loads, no greater than 1/60 of the span
4. Framing Member Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. of wall area when tested in accordance with ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Locate expansion and contraction points to allow for free and noiseless thermal movements from surface temperature changes.

1. Temperature Change (Range): minus 20 deg F to 180 deg F, material surfaces.

E. Fire Propagation Characteristics: MCM wall assembly passes NFPA 285 testing.

2.2 MCM WALL PANELS

A. MCM Wall Panel Systems: Provide factory-formed and -assembled, MCM wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components**,** panel stiffeners, and accessories required for weathertight system.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 0.157 inch.
2. Core: Fire retardant.
3. Exterior Finish: PVDF fluoropolymer.

a. Color: As selected by Architect from manufacturer's full range.

4. Peel Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.

C. Attachment Assembly Components: Formed from material compatible with panel facing.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

1. Aluminum Trim: Formed with 0.040-inch thick, coil-coated aluminum sheet facings.
2. Color: As selected by Architect from manufacturer's full range.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish MCM panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. PVDF Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM panels to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and MCM panel manufacturer's written recommendations.

3.3 MCM PANEL INSTALLATION

A. General: Install MCM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving MCM panels.
2. Flash and seal MCM panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by MCM panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as MCM panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support MCM wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Panel Installation: Attach MCM wall panels to supports at locations, spacings, and with fasteners recommended by Fabricator to achieve performance requirements specified.

1. DBVR System: Install using Fabricator's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by Fabricator. Attach MCM wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
   a. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use Fabricator's standard horizontal tracks and vertical tracks or drain channels that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach MCM wall panels to tracks by interlocking panel edges with Fabricator's standard "T" clips.
   b. Panel Installation:
      1) Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
      2) Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
   c. Joint Sealing: Seal all joints in accordance with AAMA 509. Do not apply sealants to joints unless otherwise indicated.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete MCM panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM panel Fabricator; or, if not indicated, provide types recommended in writing by MCM system Fabricator.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Site Verifications of Conditions:

1. Verify conditions of substrate previously installed under other Sections are acceptable for the MCM system installation. Provide documentation indicating detrimental conditions to the MCM system performance.
2. Once conditions are verified, MCM system installation tolerances are as follows:

    a. Shim and align MCM wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as MCM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of MCM panel installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After MCM panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

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SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Substrate board.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Asphalt materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
6. Tie-in with adjoining air barrier.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:

1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 19 lbf/sq. ft.
2. Zone 2 (Roof Area Perimeter): 25 lbf/sq. ft.

a. Location: From roof edge to .6h inside roof edge.

3. Zone 3 (Roof Area Corners): 34 lbf/sq. ft.

a. Location: .6h in each direction from building corner.

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

F. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.

G. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.90 and an emissivity of not less than 0.85 when tested in accordance with ANSI/CRRC S100 and a minimum three-year-aged SRI of 64 .

H. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Thickness: 80 mils, nominal.
2. Exposed Face Color: White.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, thickness as required by manufacturer, of same color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard.

E. Slip Sheet: Manufacturer's standard, of thickness required for application.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Thickness: 1/2 inch thick.
2. Surface Finish: Factory primed.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.5 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
1. Size: 48 by 48 inches.
2. Thickness:
    a. Base Layer: 2.2 inches minimum.
    b. Upper Layer: As required to meet minimum R factor.

3. Size: 48 by 48 inches.

4. Thickness: As required to achieve R-30 minimum.

B. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/2 inch.
3. Slope:

a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES AND COVER BOARD

A. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

B. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Thickness: 1/2 inch (13 mm).
2. Surface Finish: Fiberglass facer.

C. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 PREPARATION

A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours after performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches.

a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
b. Make joints between adjacent insulation boards not more than 1/4 inch in width.

c. Fill gaps exceeding 1/4 inch with insulation.
d. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches .

1) Trim insulation so that water flow is unrestricted.

f. Fill gaps exceeding 1/4 inch with insulation.
g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
h. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests:

1. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography according to ASTM C1153.

a. Perform tests before overlying construction is placed.
b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is Contractor's responsibility.

d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.

1) .

e. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

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SECTION 076110 - COPPER ROOFING

PART 1 - GENERAL

RELATED DOCUMENTS

1.1 The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Flat locked and soldered (flat seam soldered) roofing to match existing.

1.3 COORDINATION

A. Coordinate copper roofing with rain drainage work, flashing, gutters, downspouts, trim and construction of decks, parapets, walls, and other adjoining work to provide permanently watertight, secure, and noncorrosive installation.

1.4 PERFORMANCE REQUIREMENTS

A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture” handbook published by the Copper Development Association Inc. (CDA)

1. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
2. Make modifications only to meet field conditions and to ensure fitting of system components.
3. Obtain Architect’s approval of modifications.
4. Provide concealed fastening wherever possible.
5. Attachment considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
6. Obtain Architect’s approval for connections to building elements at locations other than indicated in Drawings.
7. Accommodate building structure deflections in system connections to structure.

B. Performance Requirements:

1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
2. Design system capable of withstanding building code requirements for negative wind pressure.

C. Interface With Adjacent Systems:

1. Integrate design and connections with adjacent construction.
2. Accommodate allowable tolerances and deflections for structural members in installation.

1.5 SUBMITTALS

A. Product data including metal manufacturer's specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.

B. Shop drawings showing manner of forming, joining, and securing copper roofing, and pattern of seams. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.

C. Samples consisting of 6-inch or 12-inch square specimens of specified copper roofing material.

D. Certificates: Fabricator's certification that products furnished for Project meets or exceeds specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

1.7 QUALITY ASSURANCE

A. Fabricator’s Qualifications: Company specializing in copper sheet metal roofing work with three years experience in similar size and type of installations.

B. Installer: A firm with 3 years of successful experience with installation of copper roofing of type and scope equivalent to Work of this Section.

C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture” handbook published by the Copper Development Association (CDA). Conform to dimensions and profiles shown.

D. Wind Uplift: Provide roof assemblies meeting wind uplift ratings as required by code.

E. Packing, Shipping, Handling, and Unloading: Protect finish panel faces.

1.8 WARRANTY

A. Warrant installed system and components to be free from defects in material and workmanship for period of 2 years.

B. Include coverage against leakage and damages to finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials that may be incorporated in the Work include, but are not limited to, the following:

2.2 MATERIALS

A. Copper Roofing Sheets: Cold-rolled copper sheet complying with ASTM B370 temper H00, unless otherwise indicated, and as follows:

1. Weight: 16 oz. per sq. ft. (0.0216-inch thick) unless otherwise indicated.

B. Accessories: Except as indicated as work of another specification Section, provide components required for a complete roof system, including trim, fascias, cleats, flashings, gutters, sealants, gaskets, and closure strips. Match materials and finishes of roof.

1. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

2. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.
3. Cleats
   a. Concealed type as indicated in the "Copper in Architecture" handbook published by the Copper Development Association (CDA) for flat-seam spaced on 12 inch centers.
   b. Fabricate cleats to allow thermal movement of copper roof panels while preventing copper panel distortion due to wind uplift forces.
4. Trim, Closure Pieces, and Accessories:
   a. Same material, thickness, and finish as adjacent copper roof panels, brake formed to required profiles.
   b. Comply with standards conforming to recognized industry standard sheet metal practice.

C. Bituminous Coating: SSPC - Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

D. Roofing Felt Underlayment: Asphalt saturated felt weighing not less than 30 lbs per 100 square feet.

E. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.

F. Nails for Wood Substrates: Copper or hardware bronze, 0.109 inch minimum not less than 7/8-inch long barbed with large head.

G. Screws & Bolts: Copper, bronze, brass, or passivated stainless steel (300 Series) of sufficient size and length to sustain imposed stresses.

H. Cleats: 16 or 20 oz ounce cold rolled copper, as required to sustain loads 2-inch wide x 3-inch long.

I. Solder: ASTM B32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder.

J. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

K. Rivets:

1. Pop Rivets: 1/8-inch to 3/16-inch diameter, with solid brass mandrels.
2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

2.3 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of the "Copper in Architecture" handbook published by the Copper Development Association (CDA) and other recognized industry practices. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrate. Comply with material manufacturer's instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

1. Fabricate to allow for adjustments in field for proper anchoring and joining.
2. Form sections true to shape, accurate in size, square, free from distortion and defects.
3. Cleats: Fabricate cleats and starter strips of same material as sheet, interlockable with sheet in accordance with CDA recommendations.
4. Tin edges of copper sheets and cleats at soldered joints for flat lock and soldered system.
5. Flat Locked and Soldered (Flat Seam Soldered) Panel Seams:
   a. Fabricate flat seams for solid soldered joints.

b. Fold two adjacent edges over 180 degrees for width of 3/4 inch and other two adjacent edges under 3/4 inch (19 mm). Refer to CDA "Copper in Architecture Handbook".
c. Tin edges of panels at least 1 ½ inch prior to forming seams, and as soon as possible prior to installation.
d. Fabricate seams for panels to be installed in overlapped, interlocking shingle manner for locked down engaged seams.

B. Seams: Fabricate nonmoving seams in copper sheet with flat-lock seams. Tin edges and cleats to be soldered, form seams, and solder.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion-type joints are indicated or required for proper performance of work, form copper to provide for proper installation of elastomeric sealant, in compliance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).

E. Separations: Provide for separation of copper from noncompatible metal or corrosive substrate by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Solder:

1. Solder and seal non-moving copper joints on slopes up to 3:12, except those indicated or required to be expansive type joints.
2. After soldering, remove flux. Wipe and wash solder joints clean. Refer to CLEANING Article in PART 3.

2.4 FINISHES

A. Natural weathering mill finished copper. No applied finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine conditions and proceed with work when substrates are ready.

B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

C. Verify roof openings, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

D. Roofing Felt Underlayment:
1. Install underlayment over solid substrates with horizontal overlaps and endlaps staggered.
2. Lay parallel to ridge line with 2-1/2 inch sidelaps and 6 inch endlaps.
3. Start application at low point, working up deck laying plies in shingle fashion.
4. Fasten underlayment with copper roofing nails spaced on 12 inch centers maximum.

E. Install underlayment and paper slip sheet on substrate under copper roofing to greatest extent possible unless otherwise recommended by manufacturer of sheet metal. Paper slip sheets must be installed over the underlayment. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under copper roofing. Lap joints 2 inch minimum.

3.2 INSTALLATION

A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of copper being fabricated and installed.

B. General:

1. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized asphalt or butyl underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
2. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of copper roofing to profiles, patterns, and drainage arrangements shown and as required for permanently leakproof construction. Provide for thermal expansion and contraction of the work, as indicated. Seal joints as shown and as required for leakproof construction. Shop-fabricate materials to greatest extent possible.
3. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1-inch into sealant. Form joints to conceal sealant completely. When ambient temperature is moderate at time of installation, 40 degrees to 70 degrees F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher or lower ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F. Comply with requirements of Division 07 "Joint Sealant" Sections for handling and installing sealants.
4. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
5. Conceal fasteners and expansion provisions where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
6. Tin uncoated copper surfaces and cleats at edges of flat seam panel sheets to be soldered, for a width of 1-1/2 inch, using solder recommended for copper work.

C. Flat Lock Soldered (“Flat Seam Soldered”) Seam Roofing:

1. Install copper work in accordance with CDA "Copper in Architecture Handbook".
2. Flat Seam Metal Roof Panels: Fasten system to substrate with concealed metal cleats and screws at spacings required by fabricator to resist code required wind uplift.
3. Align, level, and plumb system with structure.
4. Fasten cleats or nails using cleats mated to folded flat seams and fastener pattern to resist design loads with screws or barbed nails of sufficient length to penetrate substrate.
5. Tin and prepare panels as described in specification Section 2.3 “Fabrication”.
6. Only install the number of panels in a day that can be field soldered before the end of the day’s work. Install overnight protection on the unsoldered tinned edges of panel seams to prevent contamination before the start of the next work day.
7. Fully seat adjacent panel to on two sides to achieve continuous engagement of seam joint.
8. Mallet or dress down engaged seams.
9. Apply flux and fully sweat seams with solder to achieve watertight installation.
10. Install expansion battens at 25 to 30 feet in both directions.

3.3 CLEANING

A. Remove protective film (if any) from exposed surfaces of copper roofing promptly upon installation. Strip with care to avoid damage to finishes.

B. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.

C. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

3.4 PROTECTION

A. Provide final protection in a manner acceptable to installer that ensures that copper roofing is without damage or deterioration at time of Substantial Completion.

END OF DOCUMENT 076110

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.
4. Gutters.
5. Downspouts.
6. Metal copings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of roof-penetration flashing.
9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Details of special conditions.

11. Details of connections to adjoining work.
12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

B. Product test reports.

C. Research reports.

D. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.

B. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop is to be listed as able to fabricate required details as tested and approved.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Design Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

E. FM Approvals Listing: Manufacture and install roof edge flashings and copings that comply with requirements in FM Approvals 4471 as part of a roofing system and that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, Class 1A-75. Identify materials with name of fabricator and design approved by FM Approvals.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Thickness: 0.032 inch.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
6. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.

C. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

1. Thickness: 20 oz./sq. ft.
2. Nonpatinated, Exposed Finish: Mill.

2.3 UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

E. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

F. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material:
   a. Existing building: Copper, 16 oz./sq. ft.
   b. New Construction: Galvanized steel, 0.022 inch thick or Aluminum, 0.024 inch thick to match flashing material.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
4. Accessories:

   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

5. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate seamless gutters.
3. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Style: Painted 6” Aluminum Half Round Reverse Bead Gutters
5. Shop fabricate interior and exterior corners.
6. Accessories.
   a. Downspout tile adapters
7. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:

   a. Aluminum: 0.032 inch thick.
   b. Color: Match existing.

B. Downspouts: Fabricate downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Style.
   a. 4” round painted aluminum.
2. Shop fabricate elbows
3. Hanger Style: Diamond Bands.
4. Fabricate from the following materials:

   a. Aluminum: 0.024 inch thick.
   b. Color: Match existing.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Fabricate from the following materials:

   a. Aluminum: 0.050 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft

B. Valley Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft.

C. Drip Edges: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.

        1) Do not install sealant-type joints at temperatures below 40 deg.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches ; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

    a. Fill joint completely.
    b. Completely remove flux and spatter from exposed surfaces.

5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with soldered joints.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Connect downspouts to underground drainage system.

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements**,** sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF DOCUMENT 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

1.2 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

B. Section Includes: Manufactured units for the following applications:

1. Copings.
2. Reglets and counter flashings.
3. Ridge Cap

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For roof specialties.

1. Plans, expansion-joint locations, keyed details, and attachments to other work. Distinguish between factory pre-manufactured- and field-assembled installation.
2. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Details of termination points and assemblies, including fixed points.
5. Details of special conditions.

C. Samples: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Research reports.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 WARRANTY

Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 - Thermoplastic-Polyolefin (TPO) Roofing

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, Class 1-105. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that

resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 ft., concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Formed Aluminum Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.

a. Surface: Smooth, flat finish.
b. Finish: Two-coat fluoropolymer.
c. Color: As indicated on drawings.

2. Corners: Factory mitered and soldered.
3. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Formed Aluminum Sheet: 0.050 inch thick.
2. Corners: Factory mitered and soldered.
3. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
4. Multiuse Type, Embedded: For multiuse embedment in masonry mortar joints.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 ft. designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum Sheet: 0.024 inch.

C. VENTED RIDGE CAP ROOF FLASHING

1. Copper Ridge Cap Flashing; Basis of design - K & M Sheet Metal, 1310 East Cornwallis Rd. – Durham, NC 27713, (919)544-8887.
2. Material: 20 oz. copper

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Finishes:

1. Aluminum: two-coat fluoropolymer.

a. Color: As selected by Architect from manufacturer's full range to match aluminum coping.

2.4 SHEET METAL MATERIALS

A. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight in color coat.

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Roof specialty manufacturer's recommended fasteners, designed to meet performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
2. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer's written installation instructions.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 ft, with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended in writing by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roof specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.2 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.3 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.4 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077100

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SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Roof hatches.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.

B. Qualification statements.

1.5 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.

B. Installer: A minimum of 2 years experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.6 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase.

Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

1.7 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCHES

A. Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides and integrally formed deck-mounting flange at perimeter bottom.

B. Type and Size:

1. Single-leaf lid, 36 by 36 inches.

C. PERFORMANCE CHARACTERISTICS:

1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span and a maximum design pressure of +/- 100 PSf with a design factor of 2 for galvanized steel (Type S-20).

2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

3. Operation of the cover shall not be affected by temperature.

4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

D. Cover: Shall be: 14 gauge galvannealed steel with a 3” beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

E. Cover insulation: Shall be polyisocyanurate of 2” thickness, fully covered and protected by a metal liner 22 gauge galvannealed steel.

F. Curb: Shall be 12” in height above roofing surface and of 14 gauge galvannealed steel. The curb shall be formed with a 3-1/2” flange with 7/16” holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners.

G. Curb insulation: Shall be polyisocyanurate of 2” thickness on outside of curb.

H. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe.

I. Hardware
1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” diameter red vinyl grip handle to permit easy release for closing.
6. All hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

J. Finishes: Factory finish shall be manufacturers standard yellow powder coat paint over alkyd based red oxide primed steel.

1. Nailer: Factory-installed wood nailer continuous around hatch perimeter.

K. Safety Railing System: Standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Closing and Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain-entrapped water in hollow sections of handrail and railing members.
8. Fully insulate and thermally broken construction.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard.

a. Color: As selected by Architect from manufacturer's full range.

2.3 METAL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653/A653M, G90 coating designation coating designation; structural quality.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Powder Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M unless otherwise indicated.

C. Steel Tube: ASTM A500/A500M, round tube.

D. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized in accordance with ASTM A123/A123M.

E. Steel Pipe: ASTM A53/A53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.2 INSTALLATION OF ROOF ACCESSORIES

A. Roof-Hatch:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post in accordance with manufacturer's written instructions.

B. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 CLEANING AND PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.

B. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetration firestopping systems.
2. Penetrations in fire-resistance-rated walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Listed system designs.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

B. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestop systems installed with products bearing the classification marking of a qualified testing agency.

1) UL in its online directory "Product iQ."
2) Intertek Group in its "Directory of Building Products."
3) FM Approvals in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft.

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-sealant schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

B. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin,) Type O (open-cell material,) Type B (bicellular material with a surface skin,) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 4 tests for the first 500 ft. of joint length for each kind of sealant and joint substrate.
2) Perform one test for each 1,000 ft. of joint length thereafter or one test per each floor per elevation.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

B. Prepare test and inspection reports.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Acoustical joint sealants.

1.3 ACTION SUBMITTALS

A. Product data.

B. Samples: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

C. Acoustical joint-sealant schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product test reports.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.6 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

END OF SECTION 079219

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SECTION 079513.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes interior expansion joint cover assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams.

C. Samples: For each expansion joint cover assembly and for each color and texture specified.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria:

1. Type of Movement: Thermal.

a. Nominal Joint Width: As indicated on Drawings

2.3 FLOOR EXPANSION JOINT COVERS

A. Center-Plate Floor Joint Cover EJ-1: Assembly consisting of center plate that slides over metal frames fixed to sides of joint gaps.

1. Application: Floor to floor.
2. Installation: Recessed.
3. Load Capacity:

a. Live Load: 100 lb/sq. ft.
b. Maximum Deflection: 0.0625 inch.

4. Cover-Plate Design: Plain.
5. Exposed Metal:

a. Aluminum: Manufacturer's standard.

1) Color: As selected by Architect from full range of industry colors and color densities.

2.4 WALL AND CEILING EXPANSION JOINT COVERS

A. Elastomeric-Seal Wall Joint Cover EJ-2: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Application: Wall to wall.
2. Exposed Metal:

a. Aluminum: Manufacturer's standard.

1) Color: As selected by Architect from full range of industry colors and color densities.

3. Seal: Preformed elastomeric membranes or extrusions.

a. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.

B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, to comply with performance criteria for required fire-resistance rating.

D. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M.

2.6 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.7 ACCESSORIES

A. Manufacturer's standard attachment devices, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies.

C. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

D. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.
    a. Shimming is not permitted.
3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

E. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

F. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

G. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

3.2 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete.

B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.13

SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

C. Provide a system warranty for entire expansion joint assembly.

2.2 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria:

1. Type of Movement: Thermal, Wind sway.

    a. Nominal Joint Width: 2”.
    b. Minimum Joint Width: 1”.
    c. Maximum Joint Width: 3”.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Joint Cover EJ-10: Assembly consisting of Microsphere-modified 100% acrylic-impregnated pre compressed foam with watertight factory applied silicone bellows.

1. Application: Wall to wall.
2. Installation: Recessed.
3. Exposed Material Silicon:

    a. Color: As selected by Architect from full range of industry colors and color densities.

B. Exterior Below Grade Joint Cover EJ-11: Foam shall be open cell polyurethane foam impregnated with an acrylic polymer-modified, water-based asphalt emulsion. Alternates containing wax or wax compounds shall not be permitted. Impregnation agent to have proven non-migratory characteristics. Compression when expanded in joint shall be at approximately 20% of its uncompressed dimension (5x compression). Depth of seal as recommended by manufacturer.

1. Application: Foundation wall to existing foundation wall.
2. Installation: Recessed.
3. Adhesive: Manufacturer’s standard epoxy adhesive.
4. Topcoat: Manufacturer’s standard top coat.

    a. Color: Black.

C. Exterior Below Grade Joint Cover EJ-12: Heavy-duty, double-celled, extruded, thermoplastic rubber gland flanked by integral side flashing flanges deign for poured in place concrete installation.

1. Application: Roof to Wall.
2. Installation: Surface mounted.

D. Exterior roof and parapet Joint Cover EJ-13: Dual-seal, double-flanged, extruded thermoplastic rubber system for sealing expansion joints in roofs.

1. Application: Slab to slab.
2. Installation: Surface mounted.
3.

2.4 ACCESSORIES

A. Manufacturer's standard attachment devices, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

C. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

D. Install with sealed hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall expansion joint covers with roof expansion joint covers. Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.2 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.16

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SECTION 080314 - HISTORIC TREATMENT OF WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Historic treatment of wood doors in the form of the following:

a. Repairing wood doors and trim.
b. Reglazing.
c. Repairing, refinishing, and replacing hardware.

1.3 DEFINITIONS

A. Door: Generally, this term includes door frame, leaves, hardware, side panels or lights, fan light, transom, storm and screen doors, and storm vestibule unless otherwise indicated by context.

B. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.

C. Wood Door Component Terminology: Wood door components for historic treatment work include the following classifications:

1. Frame Components: Head, jambs, stop, and threshold or sill.
2. Leaf Components: Stiles, rails, and muntins.
3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
4. Interior Trim: Casing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to historic treatment of wood doors.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of exposed wood and finish.

1.6 QUALITY ASSURANCE

A. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

PART 2 - PRODUCTS

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2.1 HISTORIC TREATMENT OF WOOD DOORS QUALITY STANDARD

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grades of wood doors, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

2.2 WOOD-REPAIR MATERIALS

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A. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated because of weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

B. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound to be designed for filling voids in damaged wood materials that have deteriorated because of weathering and decay. Compound to be capable of filling deep holes and spreading to feather edge.

2.3 GLAZING MATERIALS

A. Glass: See Section 088000 "Glazing."

B. Glazing Systems:

1. Traditional Glazing Products: Glazing points and oil-based glazing putty or latex glazing compound. Tint to required color in accordance with manufacturer's written instructions.

2. Modern Glazing Products: Glazing points and single-component polyurethane glazing compound; struck to match taper of existing glazing putty (removed); colored as required to match painted sash.
3. Primers and Cleaners for Glazing: As recommended in writing by glazing material manufacturer.

2.4 HARDWARE

A. Primary Door Hardware, General: Remove, clean and repair and reinstall existing hardware except for new hardware where specified. Typically deadbolts.

B. Replacement Hardware: Replace existing damaged or missing hardware with new hardware.

C. Material and Design:

1. Material: Match existing unless otherwise indicated.
2. Design: Match type and appearance of existing hardware with architect's approval.

D. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated.

2.5 MISCELLANEOUS MATERIALS

A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; containing no boric acid.

B. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure conditions.

D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.

5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and door accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B633 for SC 3 (Severe) service condition.

2.6 WOOD DOOR FINISHES

A. Factory-Finished Units: Alkyd finish system consisting of primer and two finish coats on exposed interior wood surfaces.

1. Finish Coats: Manufacturer's standard.
2. Color and Gloss: Match existing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean wood doors and trim of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

B. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT OF WOOD DOORS, GENERAL

A. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood doors to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Remove coatings and apply borate preservative treatment before repair. Remove coatings in accordance with Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.
3. Repair items in place where possible.
4. Install temporary protective measures to protect wood door work that is indicated to be completed later.
5. Refinish historic wood doors in accordance with Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as approved by Architect.

C. Repair and Refinish Existing Hardware: Dismantle door hardware; strip paint, repair, and refinish it to match finish Samples; and lubricate moving parts just enough to function smoothly.

D. Repair Wood Doors: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood doors by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood doors by limited replacement matching existing material.

E. Protection of Openings: Where doors are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

F. Identify removed doors, frames, leaves, trim, and members with numbering system corresponding to door locations to ensure reinstallation in same location.

3.3 WOOD DOOR PATCH-TYPE REPAIR

A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.

1. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
2. Remove rotted or decayed wood down to sound wood.

B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood.

C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
3. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

3.4 GLAZING

A. Comply with combined written instructions of glass, glazing system, and glazing material manufacturers, unless more stringent requirements are indicated.

B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.

C. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.

D. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.

E. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.

F. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.

G. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless otherwise indicated.

END OF SECTION 080314

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.

10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer’s thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum thermal rating of 0.41 BTU/hr-ft2-F.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. Curries Company (CU) - Temperature Rise - 727 Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Manufacturers Basis of Design:

    a. Curries Company (CU) - Mercury 3 Thermal Break TQ Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Manufacturers Basis of Design:

a. Curries Company (CU) - C Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
8. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
9. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
10. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.

C. Samples: For factory-finished door frames.

1.4 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.2 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
2. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.

a. Species: Select white maple.
b. Cut: Plain sliced (flat sliced).
c. Match between Veneer Leaves: Book match.
d. Assembly of Veneer Leaves on Door Faces**:** Balance match.
e. Pair and Set Match: Provide for doors hung in same opening.
f. Room Match:

3. Core for Non-Fire-Rated Doors:

1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087111 "Door Hardware (Descriptive Specification."

b. Glued wood stave.
c. WDMA I.S. 10 structural composite lumber.

1) Screw Withdrawal, Edge: 475 lb (2110 N).

d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

4. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.3 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

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1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.5 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on[**top and**] bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. ANSI/WDMA I.S. 1A TR-8 UV Cured Acrylated Polyester/Urethane.
3. Staining: Match Architect's sample.
4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges at locations with not in public view.

1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory finished.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, screwdriver operated.

B. Flush Access Doors with Concealed Flanges for locations in public view:

1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory finished.
5. Frame Material: Same material and thickness as door.
6. Latch and Lock: Cam latch, key operated.

2.2 CEILING ACCESS DOOR AND FRAME

A. Exterior Flush Access Doors with Concealed Flanges for interior sealed ceiling location:
1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed piano hinge.
2. 1” thick rigid foam insulation and neoprene gasket.
3. Locations: Ceiling.
4. Metallic-Coated Steel Sheet for Door and frame: Nominal 0.064 inch, 16 gage factory prime coated for field finish.
5. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, FlushAccess Doors with Exposed Flanges:

1. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
6. Latch and Lock: Self-latching door hardware, operated by key.

B. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
6. Latch and Lock: Self-latching door hardware, operated by key.

2.4 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

a. Color: As selected by Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

END OF SECTION 083113

SECTION 083513.13 - MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel folding aluminum-framed glass doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

C. Samples: For each multipanel folding aluminum-framed glass door and for each color specified.

D. Product schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to multipanel folding aluminum-framed glass door manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel folding aluminum-framed glass doors that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period:

    a. Multipanel Folding Aluminum-Framed Glass Doors: 10 years from date of Substantial Completion.
    b. Laminated Glass: Five years from date of Substantial Completion.
    c. Aluminum Finish: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

A. Basis-of-Design Product by Manufacturer: NanaWall NW ACOUSTICAL 645 by NANA WALL SYSTEMS, INC. (415) 383-3148, www.nanawall.com.

B. Multipanel Folding Aluminum-Framed Glass Doors: Provide extruded-aluminum-framed multipanel folding glass doors, complete with glazing, threshold, support, and anchorage devices.

1. Application: Interior.
2. Stack Storage Configuration: As shown on Drawings.

C. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440. Provide factory-assembled door panels that are reglazable without dismantling panel framing, and factory-assembled frames.

1. Door Panel Design: As indicated design, with 10-inch nominal height bottom rail.
2. Adjustable sliding and folding hardware with top and bottom tracks.
3. Mounting Type:Floor track supported with upper guide track.
4. Panel Configuration: Straight .
5. Sill Type: Surface Mounted Minimal ADA Sill .
6. Panels: Single lite; standard.
7. Panel Size (W x H): As indicated on Drawings.
    a. Rail Depth: 2-5/8 inch.
    b. Top Rail and Stile Width: 2-7/8 inch.
    c. Bottom Rail Width: Manufacturer’s standard kickplate on all swing panels. Height of 10 inches.
    d. Frame Depth: -15/16 inch.
    e. Head Track Width: 2-13/16 inch standard.
    f. Side Jamb Width: 2 inches.
    g. Sill Finish: Black anodized finish.
8. Aluminum Extrusion: AIMgSi0.5 alloy, 6063-T5.
    a. Thickness: 0.078 inch nominal.

b. Acoustic Break: 1-1/4 inch wide specially designed glass fiber reinforced (GFR) polyamide for panels.

9. Aluminum Finish: One color inside and outside. (AAMA 611- Clear or AAMA 2604- Powder Coat)
   a. Finish Type: Choose from Manufacturer's Standard Colors.

D. Acoustic Performance.

1. System STC (Rw) 44 (44) and 1-9/16 inch (40 mm) double IGU, 10 mm + 8 mm STC 48 enhanced laminated glass or approved equal configuration.

2.2 GLAZING

A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal.

1. Glass: ASTM C1036, Type 1, q3; Category II safety glass complying with testing requirements in 16 CFR 1201.

2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

3. Manufacturer's glass lites in insulated glazing units, dry glazed with glass stops on the inside.
   a. 1 7/16", 6 mm + 6 mm STC 42 laminated glass to achieve unit STC of 40
   b. Glass Spacer: Black; standard

2.3 HARDWARE

A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel folding aluminum-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.

B. Panel Support System: Provide panel support system designed for size, weight, and performance requirements of multipanel folding aluminum-framed glass doors indicated. Provide carriers with sealed ball bearings.

1. Overhead Supported: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than 0.10 inch between supports when fully loaded.
2. Bottom Supported: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track.
3. Adjustment: Provide panel support system capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.

4. Threshold Configuration: Extruded-aluminum threshold with low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines.

    a. Aluminum Finish: To match panel.

C. Panel Hinges: Stainless steel, multileaf hinge with painted finish to match exterior. Provide integral hangers and guides for hinges that engage panel support system.

1. Hinges: Black anodized aluminum with stainless steel security hinge pins and set-screws.

D. Sound Gasketing: Manufacturer’s double layer EPDM between panels and EPDM gasket, Q-Ion gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.

E. Locking System:

1. Panel Pairs: Provide manufacturer's standard handles and two-point locking device that operates concealed top and bottom rods at each panel pair.
2. Trim Design: As selected from manufacturer's full range.

    a. Finish: As selected from manufacturer's full range of finishes.

2.4 ACCESSORIES

A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.

B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel folding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

2.5 FABRICATION

A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

B. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory.

2.6 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel folding aluminum-framed glass doors, hardware, accessories, and other components.

B. Install multipanel folding aluminum-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Multipanel folding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.

3.3 ADJUSTING

A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

B. Adjust hardware and operable panels to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION 083513.13

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SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor Barriers.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.

B. General Performance: Comply with specified performance requirements, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.23 as determined in accordance with NFRC 200.

3. Air Leakage:

    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.

H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone enhanced protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 EXTERIOR AND VESTIBULE ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Interior Glass Wall Framing Construction: Nonthermal.
4. Glazing System: Retained mechanically with gaskets on four sides.
5. Glazing Plane: Front.
6. Finish: High-performance organic finish.
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.4 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.6 ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: Match Architect's sample. White to match wood clad windows, medium gloss.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of one test in area as agreed upon with Owner and Architect.

C. Aluminum-framed storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084313

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SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum-clad exterior / wood interior windows. Window types include double hung, fixed, casement and transom.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C1036 - Standard Specification for Flat Glass.
2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
5. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Difference.
6. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
7. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

B. American Architectural Manufacturers Association/Window and Door Manufacturers Association/Canadian Standards Association (AAMA/WDMA/CSA):

1. AAMA/WDMA/CSA 101/I.S.2/A440-08/NAFS – North American Fenestration Standard/Specification for Windows, Doors and Skylights.

C. Window and Door Manufacturers Association (WDMA):

1. WDMA I.S.2 – Hallmark Certification Program.

2. WDMA 4-05 - Industry Standard for Water Repellent Preservative Non-Pressure Treatment for Millwork.

D. American Architectural Manufacturers Association (AAMA):

1. AAMA 450 – Voluntary Performance Rating Method for Mulled Fenestration Assemblies.
2. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

E. National Fenestration Rating Council (NFRC):

1. NFRC 102 - Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
3. NFRC 500 - Procedure for Determining Fenestration Product Condensation Resistance Values.
4. ENERGY STAR® Compliant Models available.

F. Insulating Glass Certification Council (IGCC).

G. Safety glass tested in accordance with ANSI Z97.1.

H. Forest Stewardship Council® (FSC®):

1. FSC-STD-40-003 V1-0 – Standard for Multi-site Certification of Chain of Custody Operations.
2. FSC-STD-40-004 V2-1 – Standard for Chain of Custody Certification.

1.3 PERFORMANCE REQUIREMENTS

A. Design and performance requirements:
1. Double-hung Picture windows shall be Hallmark certified in compliance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08:
2. Air infiltration shall not exceed 0.30 cfm/ft^2 when tested at 1.57 psf according to ASTM E283.
3. No water penetration when tested at the following pressure according to ASTM E547:
4. Double-hung tilt windows must withstand the following positive/negative structural test pressure without damage when tested according to ASTM E330:
5. Double-hung tilt windows must pass a forced entry resistance test of at least Grade 10 to meet requirements set forth in ASTM F588.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Shop Drawings: For wood windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

E. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Products must be certified by independent third parties and labeled as having been produced in compliance with the accepted principles of sustainable forest management. Current sustainability certification systems that comply include the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and Program for the Endorsement of Forest Certification (PEFC).

B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: A vendor that is certified for chain of custody by a SFI-, FSC-, or PEFC-accredited certification body.

D. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

E. Mockups: Build single mockup in existing opening to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical window installation as indicated on Drawings including all moldings and finishes.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Wood rot: 30-year warranty.
c. Glazing Units, Non-laminated: 20 years from date of Substantial Completion.
d. Glazing Units, Laminated: 10 years from date of Substantial Completion.
e. Aluminum-Cladding Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 50.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.28 Btu/sq. ft. x h x deg.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.17.

E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone enhanced protection.

1. Large-Missile Test: For all glazing.

2.3 WOOD WINDOWS

A. Aluminum-Clad Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pella Corporation; Architect Series windows or comparable product by one of the following:

a. WeatherShield
b. Andersen Windows, Inc.; Andersen Corporation.
c. Marvin.
d. Jenweld.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: swing in.
2. Double hung.
3. Fixed.
4. Fixed transom.

C. Certified Wood: Wood products to be labeled in accordance with the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004 or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.

D. Certified Wood: Wood products to certified wood tracked through a chain-of-custody process. Certified wood documentation to be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

E. Certified Wood: Wood products to be certified in accordance with the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

F. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints on linear members, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

1. Exterior Finish: Aluminum-clad.

    a. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight and complying with AAMA 2605.
    b. Color: White.

2. Interior Finish: Manufacturer's standard color-coated finish.
    a. Painted Color: White.

G. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190 with two lites and complying with impact-resistance requirements in "Window Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.

    a. Tint: Clear.
    b. Kind: Heat strengthened.

2. Interior Lite: ASTM C1172 clear laminated glass with two plies of float glass.

    a. Float Glass: As required by performance requirements indicated.
    b. Interlayer Thickness: As required by performance requirements indicated.

3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second surface.

H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: White.

I. Casement Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens.

    a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Manufacturer's standard type for sash weight and size indicated.
3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one lock on sashes up to 29 inches tall and two locks on taller sashes.
4. Limit Devices: Concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash opening.

    a. Limit clear opening to 4 inches for ventilation; with custodial key release.

5. Operator Stud Cover: Matching operator handle finish. Provide in locations where operator handle is removed for controlled access.

J. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks.
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

K. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

L. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.

1. Quantity and Type: Three per sash, two permanently located at exterior and interior lites and one permanently located between insulating-glass lites.
2. Material: Manufacturer's standard.
3. Pattern: As indicated on Drawings to match existing windows to be demolished.>.
4. Profile: 7/8 inch ogee.
5. Color: To match frame color.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out\Full, outside for double-hung sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range.
3. Finish for Exterior Screens: Matching color and finish of cladding.

C. Glass-Fiber Mesh Fabric: manufacturer’s standard mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M and SMA 1201.

1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, etc.) at the points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

G. Leave windows closed and locked.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
4. Section 0811113 “Hollow Metal Doors and Frames”.
5. Section 081416 “Flush Wood Doors”.
6. Section 084313 “Aluminum-Framed Storefronts”.
7. Section 087113 “Power Door Operators”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access

control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and

electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Manufactures listed herein are for basis of design.

B. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

    a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

    a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. McKinney (MK) - QC (# wires) Option.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Match Existing, Field Verify.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.

2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Motorized electric latch retraction where the latchbolt retracts in 0.5 seconds of power being applied; removing power allows the latch to project back to the extended position.
d. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
e. Two-year limited warranty on electrified functions.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.9 DEADLOCKS AND LATCHES

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 80 Series.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 351 Series.

2.13 ELECTROHYDRAULIC DOOR OPERATORS

A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48” wide.

1. Provide operators with features as follows:

a. Non-handed with push and pull side mounting.
b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
c. Activation by push button, hands-free or radio frequency devices.
d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
e. Two-year limited warranty.
f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building’s IT required.
1) Simple setup with no app required.
2) View status and make adjustments without removing the cover.
3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
g. Mounting backplate to simplify and speed up installation.

2. Operators shall have the following functionality:

a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.

c. Infinite Hold Open: Door will hold open at set position until power is turned off.
d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
e. Open Delay: Delays operator opening for locking hardware.
f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.

3. Manufacturers:

a. Norton Rixson (NO) - 6000 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

a. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.17 ELECTRONIC ACCESSORIES

A. Touchless Switches: FCC certified microwave sensing switch used for REX or activation of various access control devices in place of a traditional wired switch. Unit to have an adjustable sensing zone from 4” to 24”. At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets.

1. Manufacturers:

a. Norton Rixson (NO) - 700 Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Manufacturers:

a. Securitron (SU) - AQL Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. AD - Adams Rite
6. OT - Other
7. NO - Norton
8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 110

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Flush Bolt (Manual)	555/557 (TO SUIT)	US32B	RO
1	Mortise Deadlock	MS1850S	628	AD
1	Thumbturn	4066	130	AD
1	Cylinder	Match/Expand Facility Existing		OT
2	Push Pull	RM251 Mtg-Type 1XHD	US32B	RO
1	Surface Closer	351 CPS	626	SA
1	Automatic Opener	6011/6021 (TO SUIT)	689	NO
1	Door Stop	403/441CU (TO SUIT)	US32B	RO
1	Rain Guard	346D		PE
2	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
2	Wave Wall Switch	700		NO

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Door to remain unlocked during occupancy.
• Electronic operation: Outside, automatic operator by wave to open switch. Inside, Free egress at all times by push plate/door pull or automatic operator by wave to open switch.

Set: 2.0

Doors: 009B

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Rim Exit Device, Storeroom	LC 16 8804 862	US10BE	SA
2	Cylinder	Match/Expand Facility Existing		OT

1	Pull	RM201 Mtg-Type 1XHD	10BE	RO
1	Surface Closer	351 CPS	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Rain Guard	346D		PE
1	Gasketing (Head/Jambs)	S773D		PE
1	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU

Set: 3.0

Doors: 009A

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Removable Mullion	L980A - DOOR HEIGHT	US28	SA
2	Rim Exit Device, Classroom	LC AD8513 ETH016	US10BE	SA
3	Cylinder	Match/Expand Facility Existing		OT
2	Surface Closer	351 CPS	EB	SA

Notes:
• Perimeter/meeting stile seals by frame/door supplier.

Set: 4.0

Doors: 106, 107, 108

1	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Passage Latch	8215 TRH016	US10BE	SA
1	Door Stop	403/441CU (TO SUIT)	10BE	RO

Notes:
• Perimeter/meeting stile seals by frame/door supplier.

Set: 5.0

Doors: 111

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
2	Push Pull	RM251 Mtg-Type 1XHD	US32B	RO
2	Automatic Opener	6011/6021 (TO SUIT)	689	NO
2	Wave Wall Switch	700		NO
1	Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Electronic operation: Outside, automatic operator by wall switch. Inside, Free egress at all times by push bar or automatic operator by wall switch.

Set: 6.0

Doors: 011

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Rim Exit Device, Storeroom	LC 8804 ETH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 O/P9 (TO SUIT)	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 7.0

Doors: 005

5	Hinge, Full Mortise, Hvy Wt	T4A3786	US10BE	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC12	US10BE	MK
1	Dust Proof Strike	570	10BE	RO
1	Flush Bolt (Automatic, set)	2842/2962 (TO SUIT)	10BE	RO
1	Fail Secure Lock	LC RX 8271-24V TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Coordinator	2600 Series x Wear Plates	Black	RO
2	Surface Closer	351 CPS	EB	SA
2	Kick Plate	K1050 10" CSK	10BE	RO
2	Silencer	608/609 (TO SUIT)		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	Provided By Security Supplier		OT
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU
1	Power Supply	AQLxx-R8E1 (TO SUIT)		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes:
•Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 8.0

Doors: 008, 010

2	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Dust Proof Strike	570	10BE	RO
2	Flush Bolt (Manual)	555/557 (TO SUIT)	10BE	RO
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
2	Cylinder	Match/Expand Facility Existing		OT
2	Surface Closer	351 O/P9 (TO SUIT)	EB	SA
2	Kick Plate	K1050 10" CSK	10BE	RO
2	Door Stop	403/441CU (TO SUIT)	10BE	RO
2	Silencer	608/609 (TO SUIT)		RO

Set: 9.0

Doors: 003

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 H	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 10.0

Doors: 006

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Office Lock	LC 8205 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 11.0

Doors: 002, 112A, 112B, 112C

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Privacy Lock	V21 8265 VN1 H016	US10BE	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Mop Plate	K1050 4" CSK	10BE	RO

1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Coat Hook	RM802	10BE	RO

Set: 12.0

Doors: 007

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Passage Latch	8215 TRH016	US10BE	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Mop Plate	K1050 4" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 14.0

Doors: X001

1	Gasketing (Head/Jambs)	S773D		PE

Set: 15.0

Doors: X004B, X100, X101B, X102, X103, X105, XST01, XST03

1	Surface Closer	351 O/P9 (TO SUIT)	EB	SA

Set: 16.0

Doors: 101

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 CPS	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Rain Guard	346D		PE
1	Gasketing (Head/Jambs)	S773D		PE
1	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU

Set: 17.0

Doors: 007B, 113

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

END OF SECTION 087100

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SECTION 087113 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Low-energy door operators for swinging doors.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Double-Egress (Doors): A pair of doors that simultaneously swing, with the two doors moving in opposite directions with no mullion between them.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.6 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POWER DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to power door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.
2. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load as shown on structural drawings.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick, extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration: Operator to control pair of swinging doors.

1. Traffic Pattern: One way.
2. Operator Mounting: Recessed into wall and/or storefront system.

D. Operation: Power opening and power-assisted spring closing. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controller.

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator**;** key operated.

G. Activation Device: Push-plate switch to activate door operator.

H. Exposed Finish: Finish matching door and frame.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.4 CONTROLS

A. General: Provide controls in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.

1. Configuration:
2. Square push plate with 4-by-4-inch junction box.

    a. Mounting: As indicated on Drawings, recess mounted into storefront or other support structure.
3. Rectangular push plate with 2-by-4-inch junction box.

    a. Mounting: As indicated on Drawings, recess mounted into storefront or other support structure.
4. Storefront recessed push plate

    a. 1-1/2" W x 4-3/4" H face plate, SPDT UL listed switch-mom, 15 amp @ 125 VAC, fits 2" frame, with blue letters and International symbol of accessibility.
5. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
6. Message: International symbol of accessibility.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.5 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Etched and painted.
2. Provide sign materials with instructions for field application when operators are installed.

2.6 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

C. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

B. Controls: Install devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel.

C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

D. Adjusting: Adjust power door operators to function smoothly and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.
2. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

E. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each power door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

B. Power door operators will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 087113

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SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product test reports.

C. Preconstruction adhesion and compatibility test report.

D. Sample warranties.

1.7 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

F. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class as required by manufacturer: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

C. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

D. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant if required by manufacturer.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and

installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6 LAMINATED GLASS SCHEDULE

A. Laminated Vision Glass Type GL-3: Two plies of heat-strengthened float glass.
1. Outer Ply: Clear float glass.
2. Inner Ply: Clear float glass.
3. Ceramic Coating Color and Pattern: As selected by Architect from manufacturer's full range.
4. Minimum Thickness of Each Glass Ply: 5 mm.

5. Interlayer Thickness: As required to meet glazing requirements.
6. Safety glazing required.

B. Ceramic-Coated, Laminated Vision Glass Type GL-3: Two plies of heat-strengthened float glass.

1. Outer Ply: Clear float glass.
2. Inner Ply: Clear float glass.
3. Ceramic Coating Color and Pattern: As selected by Architect from manufacturer's full range.
4. Minimum Thickness of Each Glass Ply: 5 mm.
5. Interlayer Thickness: As required to meet glazing requirements.
6. Coating Location: Second surface.
7. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type GL-2:

1. Basis-of-Design Product: “Solarban®” 70 (2) Clear + Clear by Vitro Architectural Glass.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 5 mm.
4. Outdoor Lite: Heat-strengthened float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Heat-strengthened float glass.
7. Low-E Coating: Sputtered on second surface.
8. Safety glazing required.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fixed extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Sample warranties.

1.5 WARRANTY

A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.

1. Wind Loads:

a. Determine loads based on pressures as indicated on Drawings.
b. Determine loads based on a uniform pressure of 20 lbf/sq. ft. or grated if indicated elsewhere in the construction documentation., acting inward or outward.
c. Determine loads based on pressures indicated on structural drawings.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal drainable-Blade Louver, Extruded Aluminum:

1. Louver Depth: 2 inch.
2. Blade spacing; 2 inch.
3. Blade Profile: Plain blade with center baffle.
4. Frame and Blade Nominal Thickness: Not less than 0.063 inch for blades and 0.063 inch for frames.
5. Louver Performance Ratings:

a. Free Area: Not less than 49 percent.
b. Point of Beginning Water Penetration: Not less than 889 fpm.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:

1. Insect Screening, Stainless Steel: 18-by-18 mesh, 0.009-inch wire or manufacturers equivalent.

D. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

E. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

F. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
4. For fastening stainless steel, use 300 series stainless steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

G. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.5 ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 089119

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.
1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.
1. Core: 5/8 inch.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or Level 3 requirements in accordance with test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

E. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.
1. Core: 5/8 inch.

2.6 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Core: 1/2 inch.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.9 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.2 FINISHING OF GYPSUM BOARD

A. Prefill open joints, rounded or beveled edges, and damaged surface areas.

B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

C. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.3 APPLICATION OF TEXTURE FINISHES

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

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SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Crack isolation membranes.
   3. Setting material.
   4. Grout materials.
   5. Ceramic tile Accessories.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Porcelain tile.
   2. Crack isolation membranes.
   3. Setting material.
   4. Grout materials.
   5. Ceramic tile Accessories.

B. Samples:

   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Ceramic tile Accessories in 6-inch lengths

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 PORCELAIN TILE

A. Porcelain Tile Type CT-1, CT-2, CT-3

1. Certification: Tile certified by the Porcelain Tile Certification Agency.
2. Face Size: See Finish Schedule.
3. Product Use Classification: Interior, Wet (IW.
4. Physical Properties: Chemical resistant when tested with indicated chemicals in accordance with ASTM C650.

a. ANSI / ISO Class A.

5. Tile Color, Glaze, and Pattern: See Finish Schedule.
6. Grout Color: As selected by Architect from manufacturer's full range>.

2.3 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product,] that complies with ANSI A118.12 for high performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Crack Isolation Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer.

2.4 SETTING MATERIALS

A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

2.6 MISCELLANEOUS MATERIALS

A. Top trim, Outside Corners and Cove Base metal trim: Profile designed specifically for wall and flooring applications; height to match tile and setting-bed thickness.

1. Description: See Finish Schedule.
2. Material and Finish: See Finish Schedule.

B. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

2.7 FLOORING TRANSITION TR-4

1. Basis of Design; Schluter®-RENO-TK

a. Stainless Steel 304

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

C. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Flooring Transitions: Install at locations indicated.

K. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

1. TCNA W242: Organic adhesive on gypsum board.

a. Ceramic Tile Type: CT-1, CT-2, CT-3.
b. Grout: Standard unsanded cement grout.
c. Joint Width: 1/8 inch.

d. Movement Joints: Types located on Drawings.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Accessories.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTAL

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.

2.2 ACOUSTICAL TILES ACT-1, ACT-2

A. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

B. Classification: See Finish Schedule.

C. Color: White.

D. Light Reflectance (LR): 85%

E. Ceiling Attenuation Class (CAC): 38.

F. Noise Reduction Coefficient (NRC): .60.

G. Edge/Joint Detail: Beveled tegular.

H. Thickness: As indicated in a schedule.

I. Modular Size: As indicated in a schedule.

2.3 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module, 24 by 24 inches.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION 095123

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE RB-1, RB-2

A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

   1. Group: I (solid, homogeneous).
   2. Style and Location:

      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient floor coverings.

B. Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Preformed.

G. Colors: As selected from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. High performance luxury vinyl floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM F1700 by a qualified testing agency.

1. Class III printed vinyl plank

2.2 HIGH PERFORMANCE VINYL FLOOR TILE RES-1

A. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.
2. Type: A, Smooth Surface.

B. Thickness: 4.5 mm.

C. Size: 25 by 1000 mm.

D. Colors and Patterns: As indicated on finish schedule.

2.3 FL0ORING TRANSITIONS

A. Wheel Traffic Transitional Mouldings

1. Manufactured from a homogeneous composition of polyvinyl chloride (PVC), high quality additives, and colorants. All Wheel Traffic Transitional Mouldings to comply with A.D.A. requirements of Section 4.5.2 Changes of Level. Thickness: 4.5 mm.
2. Size: 12 foot lengths minimum.
3. Colors and Patterns: As indicated on finish schedule.
4. Hardness: ASTM D 2240 - Not less than 85 Shore A
5. Abrasion Resistance: ASTM D 3389 - 0.22 mg/cycle.
6. Slip Resistance: ASTM D 2047 - Exceed Federal Standards and ADA recommendations of .5 for flat surfaces.
7. Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) - Class 1.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

END OF SECTION 096519

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SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Carpet tile.

2. Walk off mat.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For carpet tile installation.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE CPT-1

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Engaged Tufted Pattern Loop.

E. Density: 8,780 oz/yd³.

F. Pile Thickness: .12 inches for finished carpet tile].

G. Stitches: 7.5 inch.

H. Gage: 1/10 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.2 CARPET TILE CPT-2

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Tufted Textured Loop.

E. Density: 7,962 oz/yd³.

F. Pile Thickness: .10 inches for finished carpet tile].

G. Stitches: 9.8 inch.

H. Gage: 1/12 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

    a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.

3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.3 CARPET TILE CPT-3

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Tufted Textured Loop.

E. Density: 6,968 oz/yd³.

F. Pile Thickness: .09 inches for finished carpet tile].

G. Stitches: 8.3 inch.

H. Gage: 1/12 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

   a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.

6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.4 CARPET TILE WOM-1

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: Ecosolution Q100™ Nylon.

D. Pile Characteristic: Multi-Level Pattern Loop.

E. Density: 7,814 oz/yd³.

F. Pile Thickness: .25 inches for finished carpet tile].

G. Stitches: 8.5 inch.

H. Gage: 1/12 inch.

I. Primary Backing/Backcoating: Manufacturer's standard composite materials.

J. Secondary Backing System: Ecoworx® Tile

K. Size: As indicated on Finish Schedule.

L. Applied Treatments:

1. Soil-Resistance Treatment: SSP® Shaw Soil Protection
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

    a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

M. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.5 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Wood Subfloors: Verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099114 - EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on the following exterior substrates:

a. Steel and iron.
b. Galvanized metal.
c. Wood.
d. Fiberglass.
e. Gypsum soffit board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of topcoat product.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT PRODUCTS

A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule or match existing color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1B:

a. Zinc-Rich Prime Coat: Primer, zinc rich, inorganic, MPI #19.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.

B. Galvanized-Metal Substrates:

1. Latex System MPI EXT 5.3H:

a. Water-Based Prime Coat: Primer, galvanized, water based, MPI #134.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

C. Wood Substrates: Wood trim, Architectural woodwork, and Doors.

1. Latex System MPI EXT 6.3A:

a. Prime Coat: Primer, alkyd for exterior wood, MPI #5.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

D. Fiberglass Substrates:

1. Latex System MPI EXT 6.7A:

a. Prime Coat: Primer, bonding, solvent based, MPI #69.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

E. Exterior Gypsum Board Substrates:

1. Latex System MPI EXT 9.2A:

a. Prime Coat: Primer, latex for exterior wood (reduced), MPI #6.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

END OF SECTION 099114

SECTION 099124 - INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of topcoat product.

C. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

~~*A. Concrete Substrates, Traffic Surfaces:*~~

~~*1. Solvent-Based Concrete Floor Sealer System, MPI INT 3.2F:*~~

~~*a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.*~~
~~*b. Topcoat: Sealer, solvent based, for concrete floors, MPI #104.*~~[1]

B. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 4.2E:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

[1] Addendum 2

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System**,** MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

D. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.3N:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.4G:

a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

F. Wood Substrates: Wood trim, Architectural woodwork, Doors.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.3V:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

G. Wood Substrates: Wood paneling and casework.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.4T:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

H. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System**,** MPI INT 9.2M:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

END OF SECTION 099124

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SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Concrete, vertical surfaces.
b. Clay masonry.
c. Concrete masonry units (CMUs).
d. Steel.
e. Galvanized metal.
f. Aluminum (not anodized or otherwise coated).
g. Wood.

1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy-Modified Latex System MPI EXT 3.1E:

a. Prime Coat: Epoxy-modified latex, matching topcoat.
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5).

B. Concrete Substrates, Horizontal Surfaces:

1. Epoxy Non-Slip Deck Coating System MPI EXT 3.2C:

a. Prime Coat: As recommended in writing by topcoat manufacturer.

b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Epoxy deck coating (slip resistant), MPI #82.

C. CMU Substrates:

1. Epoxy System MPI EXT 4.2E:

a. Block Filler: Block filler, epoxy, MPI #116.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

D. Steel Substrates:

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.

c. Topcoat: Epoxy, gloss, MPI #77.

E. Galvanized-Metal Substrates:

1. Epoxy System MPI EXT 5.3C:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Epoxy System MPI EXT 5.4E:

a. Prime Coat: Primer, vinyl wash**,** MPI #80.

b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

END OF SECTION 099600

SECTION 080314 - HISTORIC TREATMENT OF WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Historic treatment of wood doors in the form of the following:

a. Repairing wood doors and trim.
b. Reglazing.
c. Repairing, refinishing, and replacing hardware.

1.3 DEFINITIONS

A. Door: Generally, this term includes door frame, leaves, hardware, side panels or lights, fan light, transom, storm and screen doors, and storm vestibule unless otherwise indicated by context.

B. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.

C. Wood Door Component Terminology: Wood door components for historic treatment work include the following classifications:

1. Frame Components: Head, jambs, stop, and threshold or sill.
2. Leaf Components: Stiles, rails, and muntins.
3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
4. Interior Trim: Casing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to historic treatment of wood doors.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of exposed wood and finish.

1.6 QUALITY ASSURANCE

A. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

PART 2 - PRODUCTS

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2.1 HISTORIC TREATMENT OF WOOD DOORS QUALITY STANDARD

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grades of wood doors, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

2.2 WOOD-REPAIR MATERIALS

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A. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated because of weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

B. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound to be designed for filling voids in damaged wood materials that have deteriorated because of weathering and decay. Compound to be capable of filling deep holes and spreading to feather edge.

2.3 GLAZING MATERIALS

A. Glass: See Section 088000 "Glazing."

B. Glazing Systems:

1. Traditional Glazing Products: Glazing points and oil-based glazing putty or latex glazing compound. Tint to required color in accordance with manufacturer's written instructions.

2. Modern Glazing Products: Glazing points and single-component polyurethane glazing compound; struck to match taper of existing glazing putty (removed); colored as required to match painted sash.
3. Primers and Cleaners for Glazing: As recommended in writing by glazing material manufacturer.

2.4 HARDWARE

A. Primary Door Hardware, General: Remove, clean and repair and reinstall existing hardware except for new hardware where specified. Typically deadbolts.

B. Replacement Hardware: Replace existing damaged or missing hardware with new hardware.

C. Material and Design:

1. Material: Match existing unless otherwise indicated.
2. Design: Match type and appearance of existing hardware with architect's approval.

D. Hardware Finishes: Comply with BHMA A156.18 for base material and finish requirements indicated.

2.5 MISCELLANEOUS MATERIALS

A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; containing no boric acid.

B. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure conditions.

D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.

5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and door accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B633 for SC 3 (Severe) service condition.

2.6 WOOD DOOR FINISHES

A. Factory-Finished Units: Alkyd finish system consisting of primer and two finish coats on exposed interior wood surfaces.

1. Finish Coats: Manufacturer's standard.
2. Color and Gloss: Match existing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean wood doors and trim of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

B. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT OF WOOD DOORS, GENERAL

A. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood doors to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Remove coatings and apply borate preservative treatment before repair. Remove coatings in accordance with Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.
3. Repair items in place where possible.
4. Install temporary protective measures to protect wood door work that is indicated to be completed later.
5. Refinish historic wood doors in accordance with Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as approved by Architect.

C. Repair and Refinish Existing Hardware: Dismantle door hardware; strip paint, repair, and refinish it to match finish Samples; and lubricate moving parts just enough to function smoothly.

D. Repair Wood Doors: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood doors by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood doors by limited replacement matching existing material.

E. Protection of Openings: Where doors are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

F. Identify removed doors, frames, leaves, trim, and members with numbering system corresponding to door locations to ensure reinstallation in same location.

3.3 WOOD DOOR PATCH-TYPE REPAIR

A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.

1. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
2. Remove rotted or decayed wood down to sound wood.

B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood.

C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
3. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

3.4 GLAZING

A. Comply with combined written instructions of glass, glazing system, and glazing material manufacturers, unless more stringent requirements are indicated.

B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.

C. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.

D. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.

E. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.

F. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.

G. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless otherwise indicated.

END OF SECTION 080314

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.

10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer’s thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum thermal rating of 0.41 BTU/hr-ft2-F.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. Curries Company (CU) - Temperature Rise - 727 Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Manufacturers Basis of Design:

    a. Curries Company (CU) - Mercury 3 Thermal Break TQ Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Manufacturers Basis of Design:

a. Curries Company (CU) - C Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
8. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
9. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
10. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.

C. Samples: For factory-finished door frames.

1.4 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.2 SOLID-CORE, FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
2. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.

a. Species: Select white maple.
b. Cut: Plain sliced (flat sliced).
c. Match between Veneer Leaves: Book match.
d. Assembly of Veneer Leaves on Door Faces**:** Balance match.
e. Pair and Set Match: Provide for doors hung in same opening.
f. Room Match:

3. Core for Non-Fire-Rated Doors:

1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087111 "Door Hardware (Descriptive Specification."

b. Glued wood stave.
c. WDMA I.S. 10 structural composite lumber.

1) Screw Withdrawal, Edge: 475 lb (2110 N).

d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

4. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.3 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

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1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.5 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on[**top and**] bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. ANSI/WDMA I.S. 1A TR-8 UV Cured Acrylated Polyester/Urethane.
3. Staining: Match Architect's sample.
4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges at locations with not in public view.

1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory finished.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, screwdriver operated.

B. Flush Access Doors with Concealed Flanges for locations in public view:

1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory finished.
5. Frame Material: Same material and thickness as door.
6. Latch and Lock: Cam latch, key operated.

2.2 CEILING ACCESS DOOR AND FRAME

A. Exterior Flush Access Doors with Concealed Flanges for interior sealed ceiling location:
1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed piano hinge.
2. 1” thick rigid foam insulation and neoprene gasket.
3. Locations: Ceiling.
4. Metallic-Coated Steel Sheet for Door and frame: Nominal 0.064 inch, 16 gage factory prime coated for field finish.
5. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, FlushAccess Doors with Exposed Flanges:

1. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
6. Latch and Lock: Self-latching door hardware, operated by key.

B. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory finished.
6. Latch and Lock: Self-latching door hardware, operated by key.

2.4 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

a. Color: As selected by Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

END OF SECTION 083113

SECTION 083513.13 - MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel folding aluminum-framed glass doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

C. Samples: For each multipanel folding aluminum-framed glass door and for each color specified.

D. Product schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to multipanel folding aluminum-framed glass door manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel folding aluminum-framed glass doors that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period:

    a. Multipanel Folding Aluminum-Framed Glass Doors: 10 years from date of Substantial Completion.
    b. Laminated Glass: Five years from date of Substantial Completion.
    c. Aluminum Finish: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

A. Basis-of-Design Product by Manufacturer: NanaWall NW ACOUSTICAL 645 by NANA WALL SYSTEMS, INC. (415) 383-3148, www.nanawall.com.

B. Multipanel Folding Aluminum-Framed Glass Doors: Provide extruded-aluminum-framed multipanel folding glass doors, complete with glazing, threshold, support, and anchorage devices.

1. Application: Interior.
2. Stack Storage Configuration: As shown on Drawings.

C. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440. Provide factory-assembled door panels that are reglazable without dismantling panel framing, and factory-assembled frames.

1. Door Panel Design: As indicated design, with 10-inch nominal height bottom rail.
2. Adjustable sliding and folding hardware with top and bottom tracks.
3. Mounting Type:Floor track supported with upper guide track.
4. Panel Configuration: Straight .
5. Sill Type: Surface Mounted Minimal ADA Sill .
6. Panels: Single lite; standard.
7. Panel Size (W x H): As indicated on Drawings.
    a. Rail Depth: 2-5/8 inch.
    b. Top Rail and Stile Width: 2-7/8 inch.
    c. Bottom Rail Width: Manufacturer’s standard kickplate on all swing panels. Height of 10 inches.
    d. Frame Depth: -15/16 inch.
    e. Head Track Width: 2-13/16 inch standard.
    f. Side Jamb Width: 2 inches.
    g. Sill Finish: Black anodized finish.
8. Aluminum Extrusion: AIMgSi0.5 alloy, 6063-T5.
    a. Thickness: 0.078 inch nominal.

b. Acoustic Break: 1-1/4 inch wide specially designed glass fiber reinforced (GFR) polyamide for panels.

9. Aluminum Finish: One color inside and outside. (AAMA 611- Clear or AAMA 2604- Powder Coat)
   a. Finish Type: Choose from Manufacturer's Standard Colors.

D. Acoustic Performance.

1. System STC (Rw) 44 (44) and 1-9/16 inch (40 mm) double IGU, 10 mm + 8 mm STC 48 enhanced laminated glass or approved equal configuration.

2.2 GLAZING

A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal.

1. Glass: ASTM C1036, Type 1, q3; Category II safety glass complying with testing requirements in 16 CFR 1201.

2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

3. Manufacturer's glass lites in insulated glazing units, dry glazed with glass stops on the inside.
   a. 1 7/16", 6 mm + 6 mm STC 42 laminated glass to achieve unit STC of 40
   b. Glass Spacer: Black; standard

2.3 HARDWARE

A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel folding aluminum-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.

B. Panel Support System: Provide panel support system designed for size, weight, and performance requirements of multipanel folding aluminum-framed glass doors indicated. Provide carriers with sealed ball bearings.

1. Overhead Supported: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than 0.10 inch between supports when fully loaded.
2. Bottom Supported: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track.
3. Adjustment: Provide panel support system capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.

4. Threshold Configuration: Extruded-aluminum threshold with low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines.

    a. Aluminum Finish: To match panel.

C. Panel Hinges: Stainless steel, multileaf hinge with painted finish to match exterior. Provide integral hangers and guides for hinges that engage panel support system.

1. Hinges: Black anodized aluminum with stainless steel security hinge pins and set-screws.

D. Sound Gasketing: Manufacturer’s double layer EPDM between panels and EPDM gasket, Q-Ion gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.

E. Locking System:

1. Panel Pairs: Provide manufacturer's standard handles and two-point locking device that operates concealed top and bottom rods at each panel pair.
2. Trim Design: As selected from manufacturer's full range.

    a. Finish: As selected from manufacturer's full range of finishes.

2.4 ACCESSORIES

A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.

B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel folding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

2.5 FABRICATION

A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

B. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory.

2.6 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel folding aluminum-framed glass doors, hardware, accessories, and other components.

B. Install multipanel folding aluminum-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Multipanel folding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.

3.3 ADJUSTING

A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

B. Adjust hardware and operable panels to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION 083513.13

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor Barriers.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.

B. General Performance: Comply with specified performance requirements, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.23 as determined in accordance with NFRC 200.

3. Air Leakage:

    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.

H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone enhanced protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 EXTERIOR AND VESTIBULE ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Interior Glass Wall Framing Construction: Nonthermal.
4. Glazing System: Retained mechanically with gaskets on four sides.
5. Glazing Plane: Front.
6. Finish: High-performance organic finish.
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.4 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.6 ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: Match Architect's sample. White to match wood clad windows, medium gloss.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of one test in area as agreed upon with Owner and Architect.

C. Aluminum-framed storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084313

SECTION 085200 - WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum-clad exterior / wood interior windows. Window types include double hung, fixed, casement and transom.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C1036 - Standard Specification for Flat Glass.
2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
5. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Difference.
6. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
7. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

B. American Architectural Manufacturers Association/Window and Door Manufacturers Association/Canadian Standards Association (AAMA/WDMA/CSA):

1. AAMA/WDMA/CSA 101/I.S.2/A440-08/NAFS – North American Fenestration Standard/Specification for Windows, Doors and Skylights.

C. Window and Door Manufacturers Association (WDMA):

1. WDMA I.S.2 – Hallmark Certification Program.

2. WDMA 4-05 - Industry Standard for Water Repellent Preservative Non-Pressure Treatment for Millwork.

D. American Architectural Manufacturers Association (AAMA):

1. AAMA 450 – Voluntary Performance Rating Method for Mulled Fenestration Assemblies.
2. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

E. National Fenestration Rating Council (NFRC):

1. NFRC 102 - Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
3. NFRC 500 - Procedure for Determining Fenestration Product Condensation Resistance Values.
4. ENERGY STAR® Compliant Models available.

F. Insulating Glass Certification Council (IGCC).

G. Safety glass tested in accordance with ANSI Z97.1.

H. Forest Stewardship Council® (FSC®):

1. FSC-STD-40-003 V1-0 – Standard for Multi-site Certification of Chain of Custody Operations.
2. FSC-STD-40-004 V2-1 – Standard for Chain of Custody Certification.

1.3 PERFORMANCE REQUIREMENTS

A. Design and performance requirements:
1. Double-hung Picture windows shall be Hallmark certified in compliance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08:
2. Air infiltration shall not exceed 0.30 cfm/ft^2 when tested at 1.57 psf according to ASTM E283.
3. No water penetration when tested at the following pressure according to ASTM E547:
4. Double-hung tilt windows must withstand the following positive/negative structural test pressure without damage when tested according to ASTM E330:
5. Double-hung tilt windows must pass a forced entry resistance test of at least Grade 10 to meet requirements set forth in ASTM F588.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Shop Drawings: For wood windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

E. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Products must be certified by independent third parties and labeled as having been produced in compliance with the accepted principles of sustainable forest management. Current sustainability certification systems that comply include the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and Program for the Endorsement of Forest Certification (PEFC).

B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: A vendor that is certified for chain of custody by a SFI-, FSC-, or PEFC-accredited certification body.

D. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

E. Mockups: Build single mockup in existing opening to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical window installation as indicated on Drawings including all moldings and finishes.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Wood rot: 30-year warranty.
c. Glazing Units, Non-laminated: 20 years from date of Substantial Completion.
d. Glazing Units, Laminated: 10 years from date of Substantial Completion.
e. Aluminum-Cladding Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 50.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.28 Btu/sq. ft. x h x deg.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.17.

E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone enhanced protection.

1. Large-Missile Test: For all glazing.

2.3 WOOD WINDOWS

A. Aluminum-Clad Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pella Corporation; Architect Series windows or comparable product by one of the following:

a. WeatherShield
b. Andersen Windows, Inc.; Andersen Corporation.
c. Marvin.
d. Jenweld.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: swing in.
2. Double hung.
3. Fixed.
4. Fixed transom.

C. Certified Wood: Wood products to be labeled in accordance with the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004 or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.

D. Certified Wood: Wood products to certified wood tracked through a chain-of-custody process. Certified wood documentation to be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

E. Certified Wood: Wood products to be certified in accordance with the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

F. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints on linear members, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

1. Exterior Finish: Aluminum-clad.

    a. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight and complying with AAMA 2605.
    b. Color: White.

2. Interior Finish: Manufacturer's standard color-coated finish.
    a. Painted Color: White.

G. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190 with two lites and complying with impact-resistance requirements in "Window Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.

    a. Tint: Clear.
    b. Kind: Heat strengthened.

2. Interior Lite: ASTM C1172 clear laminated glass with two plies of float glass.

    a. Float Glass: As required by performance requirements indicated.
    b. Interlayer Thickness: As required by performance requirements indicated.

3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second surface.

H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: White.

I. Casement Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens.

    a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Manufacturer's standard type for sash weight and size indicated.
3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one lock on sashes up to 29 inches tall and two locks on taller sashes.
4. Limit Devices: Concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash opening.

    a. Limit clear opening to 4 inches for ventilation; with custodial key release.

5. Operator Stud Cover: Matching operator handle finish. Provide in locations where operator handle is removed for controlled access.

J. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks.
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

K. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

L. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.

1. Quantity and Type: Three per sash, two permanently located at exterior and interior lites and one permanently located between insulating-glass lites.
2. Material: Manufacturer's standard.
3. Pattern: As indicated on Drawings to match existing windows to be demolished.>.
4. Profile: 7/8 inch ogee.
5. Color: To match frame color.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out\Full, outside for double-hung sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range.
3. Finish for Exterior Screens: Matching color and finish of cladding.

C. Glass-Fiber Mesh Fabric: manufacturer’s standard mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M and SMA 1201.

1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, etc.) at the points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

G. Leave windows closed and locked.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
4. Section 0811113 “Hollow Metal Doors and Frames”.
5. Section 081416 “Flush Wood Doors”.
6. Section 084313 “Aluminum-Framed Storefronts”.
7. Section 087113 “Power Door Operators”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access

control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and

electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Manufactures listed herein are for basis of design.

B. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

    a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

    a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. McKinney (MK) - QC (# wires) Option.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. Match Existing, Field Verify.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.

2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Motorized electric latch retraction where the latchbolt retracts in 0.5 seconds of power being applied; removing power allows the latch to project back to the extended position.
d. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
e. Two-year limited warranty on electrified functions.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.9 DEADLOCKS AND LATCHES

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 80 Series.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 351 Series.

2.13 ELECTROHYDRAULIC DOOR OPERATORS

A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48” wide.

1. Provide operators with features as follows:

a. Non-handed with push and pull side mounting.
b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
c. Activation by push button, hands-free or radio frequency devices.
d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
e. Two-year limited warranty.
f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building’s IT required.
1) Simple setup with no app required.
2) View status and make adjustments without removing the cover.
3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
g. Mounting backplate to simplify and speed up installation.

2. Operators shall have the following functionality:

a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.

c. Infinite Hold Open: Door will hold open at set position until power is turned off.
d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
e. Open Delay: Delays operator opening for locking hardware.
f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.

3. Manufacturers:

a. Norton Rixson (NO) - 6000 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

a. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.17 ELECTRONIC ACCESSORIES

A. Touchless Switches: FCC certified microwave sensing switch used for REX or activation of various access control devices in place of a traditional wired switch. Unit to have an adjustable sensing zone from 4” to 24”. At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets.

1. Manufacturers:

a. Norton Rixson (NO) - 700 Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Manufacturers:

a. Securitron (SU) - AQL Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. AD - Adams Rite
6. OT - Other
7. NO - Norton
8. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 110

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Flush Bolt (Manual)	555/557 (TO SUIT)	US32B	RO
1	Mortise Deadlock	MS1850S	628	AD
1	Thumbturn	4066	130	AD
1	Cylinder	Match/Expand Facility Existing		OT
2	Push Pull	RM251 Mtg-Type 1XHD	US32B	RO
1	Surface Closer	351 CPS	626	SA
1	Automatic Opener	6011/6021 (TO SUIT)	689	NO
1	Door Stop	403/441CU (TO SUIT)	US32B	RO
1	Rain Guard	346D		PE
2	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
2	Wave Wall Switch	700		NO

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Door to remain unlocked during occupancy.
• Electronic operation: Outside, automatic operator by wave to open switch. Inside, Free egress at all times by push plate/door pull or automatic operator by wave to open switch.

Set: 2.0

Doors: 009B

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Rim Exit Device, Storeroom	LC 16 8804 862	US10BE	SA
2	Cylinder	Match/Expand Facility Existing		OT

1	Pull	RM201 Mtg-Type 1XHD	10BE	RO
1	Surface Closer	351 CPS	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Rain Guard	346D		PE
1	Gasketing (Head/Jambs)	S773D		PE
1	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU

Set: 3.0

Doors: 009A

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Removable Mullion	L980A - DOOR HEIGHT	US28	SA
2	Rim Exit Device, Classroom	LC AD8513 ETH016	US10BE	SA
3	Cylinder	Match/Expand Facility Existing		OT
2	Surface Closer	351 CPS	EB	SA

Notes:
• Perimeter/meeting stile seals by frame/door supplier.

Set: 4.0

Doors: 106, 107, 108

1	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
1	Passage Latch	8215 TRH016	US10BE	SA
1	Door Stop	403/441CU (TO SUIT)	10BE	RO

Notes:
• Perimeter/meeting stile seals by frame/door supplier.

Set: 5.0

Doors: 111

2	Continuous Hinge	DFM__SLF-HD1 - DOOR HEIGHT		PE
2	Push Pull	RM251 Mtg-Type 1XHD	US32B	RO
2	Automatic Opener	6011/6021 (TO SUIT)	689	NO
2	Wave Wall Switch	700		NO
1	Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Electronic operation: Outside, automatic operator by wall switch. Inside, Free egress at all times by push bar or automatic operator by wall switch.

Set: 6.0

Doors: 011

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Rim Exit Device, Storeroom	LC 8804 ETH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 O/P9 (TO SUIT)	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 7.0

Doors: 005

5	Hinge, Full Mortise, Hvy Wt	T4A3786	US10BE	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC12	US10BE	MK
1	Dust Proof Strike	570	10BE	RO
1	Flush Bolt (Automatic, set)	2842/2962 (TO SUIT)	10BE	RO
1	Fail Secure Lock	LC RX 8271-24V TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Coordinator	2600 Series x Wear Plates	Black	RO
2	Surface Closer	351 CPS	EB	SA
2	Kick Plate	K1050 10" CSK	10BE	RO
2	Silencer	608/609 (TO SUIT)		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	Provided By Security Supplier		OT
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU
1	Power Supply	AQLxx-R8E1 (TO SUIT)		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		OT

Notes:
•Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

Set: 8.0

Doors: 008, 010

2	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Dust Proof Strike	570	10BE	RO
2	Flush Bolt (Manual)	555/557 (TO SUIT)	10BE	RO
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
2	Cylinder	Match/Expand Facility Existing		OT
2	Surface Closer	351 O/P9 (TO SUIT)	EB	SA
2	Kick Plate	K1050 10" CSK	10BE	RO
2	Door Stop	403/441CU (TO SUIT)	10BE	RO
2	Silencer	608/609 (TO SUIT)		RO

Set: 9.0

Doors: 003

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 H	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 10.0

Doors: 006

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Office Lock	LC 8205 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 11.0

Doors: 002, 112A, 112B, 112C

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Privacy Lock	V21 8265 VN1 H016	US10BE	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Mop Plate	K1050 4" CSK	10BE	RO

1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Coat Hook	RM802	10BE	RO

Set: 12.0

Doors: 007

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Passage Latch	8215 TRH016	US10BE	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Mop Plate	K1050 4" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 14.0

Doors: X001

1	Gasketing (Head/Jambs)	S773D		PE

Set: 15.0

Doors: X004B, X100, X101B, X102, X103, X105, XST01, XST03

1	Surface Closer	351 O/P9 (TO SUIT)	EB	SA

Set: 16.0

Doors: 101

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Surface Closer	351 CPS	EB	SA
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Rain Guard	346D		PE
1	Gasketing (Head/Jambs)	S773D		PE
1	Sweep (w/ drip edge)	3452DNB		PE
1	Threshold	252x3DFG MSES25SS		PE
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU

Set: 17.0

Doors: 007B, 113

1	Continuous Hinge	DFM__HD1 - DOOR HEIGHT		PE
1	Storeroom Lock	LC 8204 TRH016	US10BE	SA
1	Cylinder	Match/Expand Facility Existing		OT
1	Kick Plate	K1050 10" CSK	10BE	RO
1	Door Stop	403/441CU (TO SUIT)	10BE	RO
3	Silencer	608/609 (TO SUIT)		RO

END OF SECTION 087100

SECTION 087113 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Low-energy door operators for swinging doors.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Double-Egress (Doors): A pair of doors that simultaneously swing, with the two doors moving in opposite directions with no mullion between them.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.6 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POWER DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to power door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.
2. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load as shown on structural drawings.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick, extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration: Operator to control pair of swinging doors.

1. Traffic Pattern: One way.
2. Operator Mounting: Recessed into wall and/or storefront system.

D. Operation: Power opening and power-assisted spring closing. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controller.

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator**;** key operated.

G. Activation Device: Push-plate switch to activate door operator.

H. Exposed Finish: Finish matching door and frame.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.4 CONTROLS

A. General: Provide controls in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.

1. Configuration:
2. Square push plate with 4-by-4-inch junction box.

    a. Mounting: As indicated on Drawings, recess mounted into storefront or other support structure.
3. Rectangular push plate with 2-by-4-inch junction box.

    a. Mounting: As indicated on Drawings, recess mounted into storefront or other support structure.
4. Storefront recessed push plate

    a. 1-1/2" W x 4-3/4" H face plate, SPDT UL listed switch-mom, 15 amp @ 125 VAC, fits 2" frame, with blue letters and International symbol of accessibility.
5. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
6. Message: International symbol of accessibility.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.5 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Etched and painted.
2. Provide sign materials with instructions for field application when operators are installed.

2.6 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

C. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

B. Controls: Install devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel.

C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

D. Adjusting: Adjust power door operators to function smoothly and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.
2. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

E. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each power door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

B. Power door operators will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product test reports.

C. Preconstruction adhesion and compatibility test report.

D. Sample warranties.

1.7 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

F. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class as required by manufacturer: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

C. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

D. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant if required by manufacturer.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and

installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6 LAMINATED GLASS SCHEDULE

A. Laminated Vision Glass Type GL-3: Two plies of heat-strengthened float glass.
1. Outer Ply: Clear float glass.
2. Inner Ply: Clear float glass.
3. Ceramic Coating Color and Pattern: As selected by Architect from manufacturer's full range.
4. Minimum Thickness of Each Glass Ply: 5 mm.

5. Interlayer Thickness: As required to meet glazing requirements.
6. Safety glazing required.

B. Ceramic-Coated, Laminated Vision Glass Type GL-3: Two plies of heat-strengthened float glass.

1. Outer Ply: Clear float glass.
2. Inner Ply: Clear float glass.
3. Ceramic Coating Color and Pattern: As selected by Architect from manufacturer's full range.
4. Minimum Thickness of Each Glass Ply: 5 mm.
5. Interlayer Thickness: As required to meet glazing requirements.
6. Coating Location: Second surface.
7. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type GL-2:

1. Basis-of-Design Product: “Solarban®” 70 (2) Clear + Clear by Vitro Architectural Glass.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 5 mm.
4. Outdoor Lite: Heat-strengthened float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Heat-strengthened float glass.
7. Low-E Coating: Sputtered on second surface.
8. Safety glazing required.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fixed extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Sample warranties.

1.5 WARRANTY

A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.

1. Wind Loads:

a. Determine loads based on pressures as indicated on Drawings.
b. Determine loads based on a uniform pressure of 20 lbf/sq. ft. or grated if indicated elsewhere in the construction documentation., acting inward or outward.
c. Determine loads based on pressures indicated on structural drawings.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal drainable-Blade Louver, Extruded Aluminum:

1. Louver Depth: 2 inch.
2. Blade spacing; 2 inch.
3. Blade Profile: Plain blade with center baffle.
4. Frame and Blade Nominal Thickness: Not less than 0.063 inch for blades and 0.063 inch for frames.
5. Louver Performance Ratings:

a. Free Area: Not less than 49 percent.
b. Point of Beginning Water Penetration: Not less than 889 fpm.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

C. Louver Screening for Aluminum Louvers:

1. Insect Screening, Stainless Steel: 18-by-18 mesh, 0.009-inch wire or manufacturers equivalent.

D. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

E. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

F. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
4. For fastening stainless steel, use 300 series stainless steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

G. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.5 ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 089119

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.
1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.
1. Core: 5/8 inch.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or Level 3 requirements in accordance with test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

E. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.
1. Core: 5/8 inch.

2.6 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Core: 1/2 inch.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.9 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.2 FINISHING OF GYPSUM BOARD

A. Prefill open joints, rounded or beveled edges, and damaged surface areas.

B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

C. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.3 APPLICATION OF TEXTURE FINISHES

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Crack isolation membranes.
   3. Setting material.
   4. Grout materials.
   5. Ceramic tile Accessories.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Porcelain tile.
   2. Crack isolation membranes.
   3. Setting material.
   4. Grout materials.
   5. Ceramic tile Accessories.

B. Samples:

   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Ceramic tile Accessories in 6-inch lengths

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 PORCELAIN TILE

A. Porcelain Tile Type CT-1, CT-2, CT-3

1. Certification: Tile certified by the Porcelain Tile Certification Agency.
2. Face Size: See Finish Schedule.
3. Product Use Classification: Interior, Wet (IW.
4. Physical Properties: Chemical resistant when tested with indicated chemicals in accordance with ASTM C650.

a. ANSI / ISO Class A.

5. Tile Color, Glaze, and Pattern: See Finish Schedule.
6. Grout Color: As selected by Architect from manufacturer's full range>.

2.3 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product,] that complies with ANSI A118.12 for high performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Crack Isolation Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer.

2.4 SETTING MATERIALS

A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

2.6 MISCELLANEOUS MATERIALS

A. Top trim, Outside Corners and Cove Base metal trim: Profile designed specifically for wall and flooring applications; height to match tile and setting-bed thickness.

1. Description: See Finish Schedule.
2. Material and Finish: See Finish Schedule.

B. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

2.7 FLOORING TRANSITION TR-4

1. Basis of Design; Schluter®-RENO-TK

a. Stainless Steel 304

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

C. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Flooring Transitions: Install at locations indicated.

K. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

1. TCNA W242: Organic adhesive on gypsum board.

a. Ceramic Tile Type: CT-1, CT-2, CT-3.
b. Grout: Standard unsanded cement grout.
c. Joint Width: 1/8 inch.

d. Movement Joints: Types located on Drawings.

END OF SECTION 093013

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SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Accessories.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTAL

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.

2.2 ACOUSTICAL TILES ACT-1, ACT-2

A. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

B. Classification: See Finish Schedule.

C. Color: White.

D. Light Reflectance (LR): 85%

E. Ceiling Attenuation Class (CAC): 38.

F. Noise Reduction Coefficient (NRC): .60.

G. Edge/Joint Detail: Beveled tegular.

H. Thickness: As indicated in a schedule.

I. Modular Size: As indicated in a schedule.

2.3 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module, 24 by 24 inches.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE RB-1, RB-2

A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

   1. Group: I (solid, homogeneous).
   2. Style and Location:

      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient floor coverings.

B. Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Preformed.

G. Colors: As selected from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. High performance luxury vinyl floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM F1700 by a qualified testing agency.

1. Class III printed vinyl plank

2.2 HIGH PERFORMANCE VINYL FLOOR TILE RES-1

A. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.
2. Type: A, Smooth Surface.

B. Thickness: 4.5 mm.

C. Size: 25 by 1000 mm.

D. Colors and Patterns: As indicated on finish schedule.

2.3 FL0ORING TRANSITIONS

A. Wheel Traffic Transitional Mouldings

1. Manufactured from a homogeneous composition of polyvinyl chloride (PVC), high quality additives, and colorants. All Wheel Traffic Transitional Mouldings to comply with A.D.A. requirements of Section 4.5.2 Changes of Level. Thickness: 4.5 mm.
2. Size: 12 foot lengths minimum.
3. Colors and Patterns: As indicated on finish schedule.
4. Hardness: ASTM D 2240 - Not less than 85 Shore A
5. Abrasion Resistance: ASTM D 3389 - 0.22 mg/cycle.
6. Slip Resistance: ASTM D 2047 - Exceed Federal Standards and ADA recommendations of .5 for flat surfaces.
7. Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) - Class 1.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Carpet tile.

2. Walk off mat.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For carpet tile installation.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE CPT-1

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Engaged Tufted Pattern Loop.

E. Density: 8,780 oz/yd³.

F. Pile Thickness: .12 inches for finished carpet tile].

G. Stitches: 7.5 inch.

H. Gage: 1/10 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.2 CARPET TILE CPT-2

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Tufted Textured Loop.

E. Density: 7,962 oz/yd³.

F. Pile Thickness: .10 inches for finished carpet tile].

G. Stitches: 9.8 inch.

H. Gage: 1/12 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

    a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.

3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.3 CARPET TILE CPT-3

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: 100% Recycled Content Nylon.

D. Pile Characteristic: Tufted Textured Loop.

E. Density: 6,968 oz/yd³.

F. Pile Thickness: .09 inches for finished carpet tile].

G. Stitches: 8.3 inch.

H. Gage: 1/12 inch.

I. Backing System: Manufacturers standard vinyl backing system, GlasBac.

J. Size: As indicated on Finish Schedule.

K. Applied Treatments:

1. Soil-Resistance Treatment: Protekt²®.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

   a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

L. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.

6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.4 CARPET TILE WOM-1

A. Color: As indicated on Finish Schedule.

B. Pattern: As indicated on Finish Schedule.

C. Fiber Content: Ecosolution Q100™ Nylon.

D. Pile Characteristic: Multi-Level Pattern Loop.

E. Density: 7,814 oz/yd³.

F. Pile Thickness: .25 inches for finished carpet tile].

G. Stitches: 8.5 inch.

H. Gage: 1/12 inch.

I. Primary Backing/Backcoating: Manufacturer's standard composite materials.

J. Secondary Backing System: Ecoworx® Tile

K. Size: As indicated on Finish Schedule.

L. Applied Treatments:

1. Soil-Resistance Treatment: SSP® Shaw Soil Protection
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

    a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

M. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within .10% of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.
5. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
6. Electrostatic Propensity: Less than 3 kV in accordance with AATCC 134.

2.5 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Wood Subfloors: Verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061600 "Sheathing."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099114 - EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on the following exterior substrates:

a. Steel and iron.
b. Galvanized metal.
c. Wood.
d. Fiberglass.
e. Gypsum soffit board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of topcoat product.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, products listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT PRODUCTS

A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule or match existing color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1B:

a. Zinc-Rich Prime Coat: Primer, zinc rich, inorganic, MPI #19.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.

B. Galvanized-Metal Substrates:

1. Latex System MPI EXT 5.3H:

a. Water-Based Prime Coat: Primer, galvanized, water based, MPI #134.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

C. Wood Substrates: Wood trim, Architectural woodwork, and Doors.

1. Latex System MPI EXT 6.3A:

a. Prime Coat: Primer, alkyd for exterior wood, MPI #5.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

D. Fiberglass Substrates:

1. Latex System MPI EXT 6.7A:

a. Prime Coat: Primer, bonding, solvent based, MPI #69.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

E. Exterior Gypsum Board Substrates:

1. Latex System MPI EXT 9.2A:

a. Prime Coat: Primer, latex for exterior wood (reduced), MPI #6.

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.

END OF SECTION 099114

SECTION 099124 - INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of topcoat product.

C. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Solvent-Based Concrete Floor Sealer System**,** MPI INT 3.2F:

a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.
b. Topcoat: Sealer, solvent based, for concrete floors, MPI #104.

B. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 4.2E:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System**,** MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

D. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.3N:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.4G:

a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

F. Wood Substrates: Wood trim, Architectural woodwork, Doors.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.3V:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

G. Wood Substrates: Wood paneling and casework.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.4T:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

H. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System**,** MPI INT 9.2M:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

END OF SECTION 099124

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Concrete, vertical surfaces.
b. Clay masonry.
c. Concrete masonry units (CMUs).
d. Steel.
e. Galvanized metal.
f. Aluminum (not anodized or otherwise coated).
g. Wood.

1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy-Modified Latex System MPI EXT 3.1E:

a. Prime Coat: Epoxy-modified latex, matching topcoat.
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5).

B. Concrete Substrates, Horizontal Surfaces:

1. Epoxy Non-Slip Deck Coating System MPI EXT 3.2C:

a. Prime Coat: As recommended in writing by topcoat manufacturer.

b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Epoxy deck coating (slip resistant), MPI #82.

C. CMU Substrates:

1. Epoxy System MPI EXT 4.2E:

a. Block Filler: Block filler, epoxy, MPI #116.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

D. Steel Substrates:

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.

c. Topcoat: Epoxy, gloss, MPI #77.

E. Galvanized-Metal Substrates:

1. Epoxy System MPI EXT 5.3C:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

F. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Epoxy System MPI EXT 5.4E:

a. Prime Coat: Primer, vinyl wash**,** MPI #80.

b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

END OF SECTION 099600

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Dimensional characters.

a. Illuminated, fabricated channel dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at ½” per foot scale.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Delegated Design Submittal: For signs indicated in "Performance Requirements" Article.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional character sign according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.

1. Illuminated Characters: Backlighted character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.

a. Removable, light diffused, Lexan back.
b. Material thickness as required by signage manufacturer.
c. Internal face of letter to be painted high gloss white.
d. Power: As indicated on electrical Drawings.

2. Character Material: Sheet or plate aluminum
3. Character Height: As indicated on Drawings.
4. Character Depth: As indicated on Drawings.
5. Finishes:

a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color **as** selected by Architect from manufacturer's full range.

6. Mounting: Projecting studs.

a. Hold characters at 1 1/2-inch distance or manufacturer's recommended distance, as confirmed by architect, from wall surface.
1) Threaded studs with sleeve spacer.
2) Stainless steel mounting studs.
3) Screw set aluminum detachable stud.
4) Stainless steel “L” brackets.

2.3 DIMENSIONAL CHARACTER MATERIALS

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed designed for masonry installation.
2. For exterior exposure, furnish nonferrous-metal devices unless otherwise indicated.

B. Adhesive: As recommended by sign manufacturer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Stainless Steel Brackets: Factory finish brackets to match sign background finish unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101419

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall covering
2. Corner guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Material certificates.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 WALL GUARDS

1. Engineered PVC FREE rigid sheet:

a. Rigid sheet should be high-impact. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer.

1) Nominal Thickness: .040”.
2) Sheet Size: 4' x10'.
3) Suede Texture.

b. Finishes:
1) Select from one of manufacturer’s solid colors.
2) Color-matched caulk, manufacturer’s trims as needed for joints/transitions**.**

2.3 CORNER GUARDS

1. Stainless steel corner guards: Surface mounted guards to be 16 gauge stainless steel.

a. 90° stainless steel corner guard with 3/16" radius and 3 1/2" legs. Mounted with construction adhesive and stainless-steel screws.
1) Finish
a) #4 Satin
b) #304 stainless steel

2.4 MATERIALS

A. Fasteners: Stainless-steel metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

B. Adhesive: As recommended by protection product manufacturer.

2.5 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
3. Adjust end and top caps as required to ensure tight seams.

END OF SECTION 102600

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.

1.3 ACTION SUBMITTALS

A. Product data.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Delegated Design Submittals: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbs concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis of design: Bobrick Classic Series

B. Toilet Tissue (Roll) Dispenser:
1. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
2. Mounting: Surface Mounted.
3. Operation: Non-control delivery with theft-resistant spindle.
4. Capacity: Designed for 5-inch-diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin.)

C. Combination Towel (Folded) Dispenser/Waste Receptacle:

1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
2. Mounting: Recessed.

a. Designed for nominal 4-inch wall depth.

3. Minimum Towel-Dispenser Capacity: 800 multifold paper towels.
4. Minimum Waste-Receptacle Capacity: 4 gal.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin.)
6. Liner: Reusable, vinyl waste-receptacle liner.
7. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

D. Soap Dispenser:

1. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
2. Mounting: Vertically oriented, surface mounted.
3. Capacity: 40 Oz.
4. Materials: Stainless steel, ASTM A480/A480M No. 4 finish (satin.)
5. Lockset: Tumbler type.
6. Refill Indicator: Window type.

E. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

3. OD: 1-1/4 inches.
4. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit:

1. Mounting: Recessed.
2. Door or Cover: Self-closing, disposal-opening cover**.**
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Sanitary Napkin/Tampon Vendor

1. Mounting: Recessed.
2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
3. Coordinate price with Owner.
4. Two tumbler door locks.
5. Separately-keyed coin box lock.

H. Seat-Cover Dispenser:

1. Mounting: Surface mounted.
2. Minimum Capacity: 250 seat covers.
3. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Lockset: Tumbler type.

I. Mirror Unit:

1. Frame: Stainless steel angle.

a. Corners: Manufacturer's standard.

2. Size: As indicated on Drawings.

3. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

J. Hook:

1. Description: Double-prong.
2. Mounting: Concealed.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin.)

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.5 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

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SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 FIRE-PROTECTION CABINET

A. Fire-Protection Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Stainless steel sheet.

D. Recessed Cabinet:
1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless steel sheet.

G. Door Style: Vertical duo panel with.

H. Door Glazing: Acrylic sheet.

1. Acrylic Sheet Color: Clear

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER".

1) Location: Applied to cabinet door.
2) Application Process: Engraved.
3) Lettering Color: Red.
4) Orientation: Vertical.

2. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Color: matte white.

2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.

a. Finish: ASTM A480/A480M No. 4 directional satin finish.
3. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), with Finish 1 (smooth or polished).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE-PROTECTION CABINETS

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
   1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 5 lbs nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Knocked-down athletic lockers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Include locker identification system and numbering sequence.

C. Samples: For each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 WELDED CORRIDOR LOCKERS

A. Doors: One piece; fabricated from 14 GA nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners.
2. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier lockers.

B. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 16 GA. nominal thickness, with single bend at sides.
2. Backs and Sides: 16 GA. nominal thickness, with full-height, double-flanged connections.
3. Shelves: No shelves required.

C. Hinges:
1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

D. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Single-Point Latching:
a. Integral Pocket and Pull: 22 gauge brushed stainless steel securely fastened to door with two lugs and a positive tamper-resistant decorative fastener.
b. Pocket Depth: Sufficient to prevent a combination padlock, built- in combination lock, or key lock from protruding beyond door face.
c. Pull: Formed in pocket.
d. Padlock Staple: Protruding through pocket.

E. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

F. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.

1. Height: 4 inches.

G. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.

1. Closures: Vertical-end type.

H. Recess Trim: Fabricated from 18 GA nominal-thickness steel sheet.

I. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.

J. Finished End Panels: Fabricated from 16 GA nominal-thickness steel sheet.

K. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

L. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach filler panels with concealed fasteners.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

END OF SECTION 105113

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 WARRANTY

A. Motorized Shade.
Basis of Design WhisperShade IQ2 by Mecho, 42-03 35TH Steet, Long Island City, NY 11101, 202-322-9221, Dana.Archer@mechoshade.com

1. Shade Hardware - 25 years unless otherwise indicated:
2. Shadecloth: Manufacturer's standard 25-year warranty.
3. Roller Shade Motors, Motor Control Systems, and Accessories: Manufacturer's standard non-depreciating 10-year warranty for AC motors and controls and 10-year warranty for DC motors, power panels and controls.
4. Roller Shade Installation: One year from date of Substantial Completion.

B. Mechanical Shade.

1. Manufacturer's standard non-depreciating, transferrable warranty for interior shading.
2. Shade Hardware – 25 years.
3. Roller Shade Installation: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MOTOR-OPERATED, SINGLE-ROLLER SHADES WT-1

A. Motorized Shades: Comply with NFPA 70.

1. Components capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
2. Operates smoothly when raising or lowering shades.
3. Cradle-to-Cradle certified and listed in C2C (DIR).
4. Electrical Components: Listed, classified, and labeled as suitable for intended purpose. Test as total system. Individual component testing is acceptable.
   a. Components: FCC compliant where applicable.
5. Voltage: 120 VAC.
6. Description: Single roller.
7. Drop Position: Regular roll.
8. Mounting: Wall mounted or recessed ceiling as indicated on drawings.
9. Size: As indicated on drawings.
10. Fabric: As indicated under Shade Fabric article.
11. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
12. Material: Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.
13. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).

14. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).
15. All bands within a single motor group shall be aligned within ¼ inch.
16. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.

B. Roller Tubes:

Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required for accommodating operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Closest proximity to J Box
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
4. Material: Corrosion-resistant steel or Extruded aluminum.
5. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
6. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.

C. Hembars: Designed to maintain bottom of shade straight and flat.

1. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
   a. Profile: Rectangular.

D. Accessories:

1. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
   a. Finish: Baked enamel.
   b. Capable of installation across two or more shade bands in one piece.
   c. Color: As selected by Architect from Manufacturer's standard colors.
   d. Profile: Square.
   e. Configuration: Continuous, fascia extends past continuous bracket.
   f. Designed to accommodate installation of motor control and wiring accessories within pocket including, but not limited to, line voltage disconnect modular connector, Wireless Controller, IQ2 Dual Splitter, and non-plenum rated daisy chain wiring.
2. Closure and Closure Mount: provided by shade contractor
   a. Provide exposed extruded aluminum closure mount and removable closure panel to provide access to shades

E. Intelligent Encoded Electronic Drive System:

1. Electronic Drive Unit (EDU) System General Requirements:

a. A UL 325 listed solution.
1) Component certification in lieu of system testing is not acceptable.
2. Listing Label and Motor Rating: To be visible for inspection without dismounting of shade assembly to remove motor or EDU from shade roller tube.
3. Size and Configuration: As recommended by manufacturer for type, size, and arrangement of shades.
4. Conceal EDU inside shade roller tube.
5. EDU Rated Speed: The same nominal speed for shades in the same room.
6. Hanging Weight of Shade Band: 80 percent of rated lifting capacity of shade EDU and tube assembly.
7. Capable of upgrading firmware from anywhere on network without touching the motor.

F. Line Voltage EDU (120 VAC):

1. Tubular, asynchronous, integral AC motor and reversible capacitor. 120 VAC, single phase, 60 Hz; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.
2. Audible Noise: 46 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.
3. Nominal Speed: 34 RPM. Not to vary due to load/lift capacity.
4. Isolated, low voltage power supply for powering external accessories connected to either the dry contact or network port.
5. Products requiring accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.

G. Modes of Operation:

1. Normal Mode: Shades move to defined intermediate stop positions and any position between defined upper and lower limits.
2. Maintenance Mode: Prevents shade from moving via dry contact or network control commands mode has been cleared/disabled.

H. Control Methods: Local isolated dry contact input and network control.

1. Local Isolated Dry Contact Inputs:
a. Local switch control, third party system integration without separate interface.
b. Moving EDU/shade to upper and lower limits and local switch preset positions.
c. Configuration of upper and lower limits, custom presets, and key modes of operation without a PC or microprocessor-based tools.
d. Configuration under protected sequences to prevent changes by casual user.
e. Switch Personalities: Configuration of dry contact control port over network such that any type of dry contact keypad/third-party interface and actuation methodology (maintained and/or momentary actuation) can be used to operate shade.
f. Dry Contact Control Connection Options to Include:
2. Five-button. Able to support configuring limits, presets, and key operating modes.

I. Alignment Positions:

1. Repeatable and precisely aligned shade positions and limits.

a. Support positioning commands from 0 to 100 percent in 1 percent increments.
b. Customizable Presets: 32.
c. Include three intermediate dry contact presets
d. Shades on same switch circuit or same network group address with same opening height, to align at each intermediate stopping position when traveling from any position, up or down.
e. Alignment of shade bands mechanically aligned on same EDU: Plus or minus 0.125 inch (3 mm).
f. Alignment of standard shades on adjacent EDUs: Plus or minus 0.25 inch (6 mm) when commanded to same alignment position.

2. Local Switch Presets:
a. Minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
b. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to 25, 50, and 75 percent of shade travel).
c. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.

J. MOTOR CONTROLS, INTERFACES, AND ACCESSORIES
1. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.
2. Digital Network Controls:
3. Reprogram control without requiring wiring modifications.
4. Ten-year non-volatile power failure memory for system configuration settings.
5. Low-Voltage Wall Controls; IQ Switch:
a. Momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
6. Control Functions:
a. Open: Automatically open controlled shades to fully open position when button is pressed.
b. Close: Automatically close controlled shades to fully closed position when button is pressed.
c. Presets: For selection of predetermined shade positions.
d. Dual Stations: For individual control of two shades/groups.
7. Finish: White.
8. Single Station: 5-button (open, close, and three intermediate stop positions).
9. Wireless Daylight Sensor
a. Sensor shall be solar powered photovoltaic requiring no wires or batteries
b. Sensor shall operate using EnOcean wireless technology, 902 MHz
c. Sensor shall have a temperature range between 32-140 degrees Fahrenheit, a sensitivity of 0-65 klux
d. Photosensor shall be daylight spectrum photopic with a field of view as follows: horizontal- 60 degree cone angle, up- 30 degrees and down- 30 degrees
e. Provide intermediate stopping positions that allow for 2, 3, 4 or 5 customizable stop positions
f. Wireless range shall be 80ft unobstructed
10. Occupancy/vacancy, based on input from wireless occupancy/vacancy sensors (where specified); shades to go to configurable unoccupied/vacant mode shade position (default of full-down) optimize energy conservation; provide configurable timers for detection of both unoccupied and occupied states.

K. Manual temporary override of shade positions:

1. IQ Switch low-voltage wall controls or touchscreen manual override panels.
2. Browser Interface: Enables control of individual shade motors, shade groups, or zones. Administrative settings allow for assignment of shade control restrictions for specific users.

L. Configurable resumption of automatic control following manual temporary override event based on wake, sunrise, sunset, sleep, time duration, and specific times.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS WT-2

1. Shade Type: Single Roller.
2. Universal drive capability to offset drive chain for reverse or regular roll shades.
3. Drop Position: Regular roll.

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated

B. Mounting: Recessed ceiling mount.

C. Size: As indicated on drawings.

D. Fabric: As indicated under Shade Fabric article.

E. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

1. Material: Steel, 1/8 inch (3 mm) thick.

F. Roller Tubes:

1. Material: Extruded aluminum.
2. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
3. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
4. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.

G. Hembars: Designed to maintain bottom of shade straight and flat.
1. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

H. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
1. Heavy-duty, 1/8” steel mounting bracket and integrated steel brake, clutch and sprocket assembly rigidly affix the shade support and user control to the building structure fully independent of the roller tube components.

2. Permanently lubricated maintenance-free brake assembly employs an oil-impregnated steel hub with wrapped spring clutch.
3. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
4. Direct drive clutch requires no interstitial gear stages or plastic parts between the building structure and clutch ensuring reliable operation across the full range of shade sizes.
5. Maximum shade hanging weight of 18 pounds (8.2 kg).

I. Drive Chain: Continuous loop stainless steel beaded ball chain, 100 pound (45 kg) minimum breaking strength. Provide upper and lower limit stops.

122413-2

1. Chain Retainer: Chain tensioning device complying with ANSI/WCMA A100.1-202.
2. Limit stops: Bead stops affixed to the chain maintain consistent shadeband alignment at the top and bottom of shade travel across multiple shades and help prevent shade damage resulting from unmanaged user control.

J. Accessories:

1. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
   a. Finish: Baked enamel.
      1) Color: As selected by Architect from Manufacturer's standard colors.
2. Can be installed across two or more shade bands in one piece.
3. Single Fascia: Accommodate regular roll shades.
4. Profile: Square.
5. Configuration: Continuous, fascia extends past continuous bracket.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Light-Filtering Fabric: ThermoVeil: 1000 series. 3 percent open, dense linear-weave pattern.
      1) Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
      2) Health Product Declaration (HPD): Published declaration with full disclosure of known hazards.

B. ROLLER SHADE FABRICATION

C. Product Safety Standard: Fabricate roller shades to comply with ANSI/WCMA A100.1-202

D. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F.

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

E. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

E. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the "Green Book") and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Basis of Design: LG-Hi-Macs by LX Hausys America, Inc. 900 Circle 75 Parkway, Suite 1500, Atlanta, GA 30339, www.lxhausys.com
2. Type: Provide Standard type or Veneer type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.
3. Colors and Patterns: As shown on Woodwork Finish legend.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Countertops:

1. 1/4-inch-thick, solid surface material laminated to 3/4-inch- thick plywood with exposed edges built up with 3/4-inch- thick, solid surface material or exposed edges faced with 1/4-inch- thick, solid surface material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Joints:

1. Fabricate countertops without joints.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves. Ensure no plywood is exposed. Build up cut edge as required for fixture installation.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.

D. Install backsplashes by adhering to wall and countertops with adhesive.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to

finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

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SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Tables and Chairs
2. Benches and Backrests
3. Litter Receptacles
4. Lighting and Bollards
5. Planters

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchorage items cast in concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: Cut Sheet for each product listed above.

B. Samples: For colors and textures specified.

C. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Trash Receptacle Inner Containers: Two full-size units for each size indicated

2. Anchors

PART 2 - PRODUCTS

2.1 TABLES AND CHAIRS

A. Table: Carousel Table. Landscapeforms, 7800 East Michigan Avenue Kalamazoo, MI 49048. Tracey Friedley tracey@nolanbrands.com 703-648-0848. www.landscapeforms.com
1. Locate as shown on plans
2. Installation Method: Surface mount per Manufacturer's Recommendations
3. Size: 90" x 33"
4. Model: Dining hoop table (3 seats) with Solstice Umbrella
5. Include umbrella hole
6. Color: Stormcloud (table and umbrella)
7. Frame Material: Aluminum with powdercoating.

B. Chair A: Adirondack Chair (Flat). Loll Designs, 5912 Waseca Street Duluth, MN 55807. 877-740-3387. www.lolldesigns.com
1. Locate as shown on plans
2. Model: SKU: AD-4SFC-NB
3. Color: Navy Blue
4. Installation Method: Freestanding in lawn panel

2.2 TRASH AND RECYCLING RECEPTACLES

A. Basis of Design Trash/Litter: SD-42. Victor Stanley Inc. (301) 855-8300; www.victorstanley.com
1. Structural Features: A receptacle with side-door to provide easy access and utility (no lifting of side door or heavy liners). Side door must have door hinges composed of stainless-steel pivot pins and oil-impregnated bronze bushings. The receptacle must have one anchor bolt hole for quick and cost-effective installation, as well as adjustable leveling feet to keep receptacle off the surface and to prevent the bottom of the steel frame from scuffing and allow easer cleaning underneath the receptacle. To prevent dirt from reaching the body of the receptacle the receptacle must also have a pedestal-style base.
2. Other features: The receptacle must have a high-density plastic liner; reinforce, ribbed and molded for durability. The steel is to have a thickness of 8-10 MILS; powder coat process must include steel shot blasting for adequate adhesion to enhance product life and appearance. The process cannot include toxic solvents.
3. Locate (1) per grouping, as shown on plans
4. Surface mount per manufacturer instructions.
5. Powdercoat finish; Color: Black
6. Material: 3/8" x 1" solid vertical steel bars with a 5/8" top ring. Steel bar material must be domestic and at least 98% of the mills' steel composition must be obtained from recycled scrap metal. The manufacturing facility cannot be of further distance than 500 miles from final destination coating.
7. Capacity: 36-gallon.
8. Standard product specifications to be provided by the manufacturer, at Owner's request.

B. Recycling: Basis of Design: SD-42 Special with side door opening, rain bonnet/restrictive lid, and recycling decals; Victor Stanley Inc. (301) 855-8300 www.victorstanley.com
1. Locate (1) per grouping, as shown on plans.
2. Surface mount per manufacturer's instructions
3. Powdercoat finish; Color: Blue
1. Material: 3/8" x 1" solid vertical steel bars with a 5/8" top ring. Steel bar material must be domestic and at least 98% of the mills' steel composition must be obtained from recycled scrap metal. The manufacturing facility cannot be of further distance than 500 miles from final destination.
2. Lids: Recycle decals; rain bonnet, restrictive lid.
3. Capacity: 36-gallon
4. Standard product specifications to be provided by the manufacturer, at Owner's request.

2.3 MISCELLANEOUS

A. Metal Screen Line System. Landscapeforms, 7800 East Michigan Avenue Kalamazoo, MI 49048. Tracey Friedley tracey@nolanbrands.com 703-648-0848. www.landscapeforms.com
1. Panel Type: Perforated Panel
2. Size: 6'-0" Ht. See plans for layouts
3. Color: Black
4. Material: Powdercoated Steel

B. Metal Screen Gate Line System. Landscapeforms, 7800 East Michigan Avenue Kalamazoo, MI 49048. Tracey Friedley tracey@nolanbrands.com 703-648-0848. www.landscapeforms.com
1. Gate Type: Perforated Panel
2. Size: 6'-0" Ht. 4'-0" Wdth. See plans for layouts
3. Color: Black
4. Material: Powdercoated Steel

C. Bike Rack BRWS-101 Bike Rack. Victor Stanley
Victor Stanley Inc. (301) 855-8300; www.victorstanley.com
1. Installation: Embedded per Manufacturer's Recommendations
2. Size: 22" x 2 3/8 OD x 36" H
3. Color: Powdercoat Black

2.4 MATERIALS

A. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.

B. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant , concealed, recessed, and capped or plugged.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on or below]-grade substrate; extent as indicated.

C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

D. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

2.5 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.6 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored or positioned, if indicated not to be anchored, at locations indicated on Drawings.

END OF SECTION

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SECTION 142123.16 - MACHINE ROOM-LESS HOLELESS HYDROLIOC PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Machine-room-less hole-less hydraulic passenger elevators as shown and specified. Elevator work includes:

1. Standard pre-engineered hydraulic passenger elevators.
2. Elevator car enclosures, hoistway entrances and signal equipment.
3. Operation and control systems.
4. Jack(s).
5. Accessibility provisions for physically disabled persons.
6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
7. Materials and accessories as required to complete the elevator installation.

B. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator’s proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum fire rating as required. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.

7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For each type of exposed finish involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Warranty Period: one year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design; Endura MRL, Passenger, twinpost above-ground by TK Elevator Corporation, Atlanta, GA. +1-844-427-5461

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 and comply with elevator seismic requirements in ASME A17.1/CSA B44.

1. Project Seismic Design Category: A.
2. Elevator Component Importance Factor: 1.0.
3. Design earthquake spectral response acceleration short period (Sds) for Project is 0.150.
4. Provide earthquake equipment required by ASME A17.1/CSA B44.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components are to be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Elevator Number(s): One.
2. Rated Load: 3500 lb.
3. Rated Speed: 100 fpm .
4. Operation System: Selective-collective automatic operation.
5. Auxiliary Operations:

    a. Standby power operation.
    b. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
    c. Automatic dispatching of loaded car.
    d. Nuisance-call cancel.
    e. Loaded-car bypass.
    f. Off-peak operation.
    g. Automatic operation of lights and ventilation fans.

6. Car Enclosures:

    a. Inside Width: Not less than 80 from side wall to side wall.

b. Inside Depth: Not less than 66 inches from back wall to front wall (return panels).
c. Inside Height: Not less than 88 inches to underside of ceiling.
d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
e. Car Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
f. Side and Rear Wall Panels Plastic laminate, or Textured stainless steel as selected by architect.
g. Reveals: Black.
h. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
i. Ceiling: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
j. Handrails: 1-1/2 inches round satin stainless steel, at sides and rear of car.
k. Floor: Standard carpet. To match finish floor.
l. Floor prepared to receive carpet (specified in Section 096813 "Tile Carpeting").

7. Hoistway Entrances:

a. Width: 42 inches.
b. Height: 84 inches.
c. Type: Single-speed side sliding
d. Frames: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
e. Doors: Satin stainless steel, ASTM A480/A480M, No. 4 finish.

8. Hall Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
9. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from stainless steel, ASTM A480/A480M, No. 4 finish.
b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.

2.4 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless.

Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

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G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform “flooded pit operation”, which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:

1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
2. An oil hydraulic pump.
3. An electric motor.
4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.

1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish with factory-applied powder coat finish entrance frame.
3. Typical door & frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish with factory-applied powder coat finish entrance frame.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:

1. Walls: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with high pressure plastic laminate.
2. Reveals and frieze: a. Reveals and frieze: Stainless steel, no. 4 brushed finish
3. Canopy: Cold-rolled steel with hinged exit.
4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in stainless steel. Exposed framework shall be stainless steel to match ceiling.
5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.

   a. Door Finish: Stainless steel panels: No. 4 brushed finish.
   b. Cab Sills: Extruded aluminum, mill finish.

7. Handrail: Provide 1 1/2' round metal on sides and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.

8. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.

9. Protection pads and buttons: One set.

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete

control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to closed.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.

8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

A. Car Operating Station, General: The main car control shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel:

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable

F. Digital Services: Cloud-based IoT monitoring system comes standard with these options:

Remote Monitoring with Application Programming Interface (API) Integration

ADA Phone - Code Compliant Cellular Connectivity

A17.1 2019 Code - Enhanced Communications

Smart Device Elevator Calling with occupant app API integration

2.09 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by

"up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:

1. Access to main control board and CP
2. Main controller diagnostics
3. Main controller fuses
4. Universal Interface Tool (UIT)
5. Remote valve adjustment
6. Electronic motor starter adjustment and diagnostics
7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
8. Operation of auxiliary pump/motor (secondary hydraulic power source)
9. Operation of electrical assisted manual lowering
10. Provide male plug to supply 110VAC into the controller
11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: (10-DOA) Upon loss of the normal power supply, building-supplied standby power is available on the same wires as the normal power supply. Once the loss of normal power is detected and standby power is available, the elevator is lowered to a pre-designated landing and the doors are opened. After passengers have exited the elevator, the doors are closed, and the car is shut down. When normal power is restored, the elevator automatically resumes operation.

E. Digital Services:

Cloud-based IoT Monitoring System (standard): Contractor shall provide a cloud-based IoT (internet of things) monitoring system capable of tracking door movements and timing, trips, power cycles, car calls, out-of-service events and modes. This observation will continue 24/7 and it shall be capable of providing service technicians a minimum of three recommended solutions for defined failure events and automatically dispatch service technicians in the event of failure(s) while sending notifications to end users of changes in their equipment's state via both email and mobile device. Access to IoT and related equipment data and status will be made available in both a web portal and mobile application secured by password and username with at least two-factor authentication. Finally, this system must be self-contained and not require internet provision by others.

Along with the monitoring system, options are available.

Remote Monitoring with Application Programming Interface (API) Integration: Contractor shall provide a portal and mobile device application (app) that communicates relevant service and operational information such as elevator operational status, open service call tickets, call ticket history and performance and service history. This system shall provide a REST application pro-

gramming interface (API) capable of transmitting relevant information from the cloud-based IoT monitoring system. This data includes equipment operational status, door movements, service and maintenance history, traffic statistics and failure alerts.

ADA Phone – Code Compliant Cellular Connectivity: Contractor shall provide a phone service through a self-contained cellular based VoIP system. This system shall meet code, include a backup battery capable of powering the emergency communication equipment for 4+ hours in the event of a power outage. The solution shall have remote monitoring capability to ensure continuous connectivity with a means of remote troubleshooting. Remote monitoring capability shall include, at a minimum, the ability to monitor connectivity and power supply. Remote monitoring shall be capable of providing local alerts to response personnel when on-site intervention is required.

A17.1 2019 Code – Enhanced Communications: For jobs installed under enforcement of 2018 International Building Code or ASME A17.1-2019/CSA B44:19 Safety Code, contractor will provide a video camera necessary for viewing the elevator cab interior floor as well as a position indicator display in the cab operating panel capable of providing means of two-way, text-based communication when the emergency call button is engaged in the elevator car. These components, and associated cloud-based monitoring platform, will be non-proprietary in nature, allowing customization on where to direct emergency calls, while offering capability for any party to provide the emergency monitoring services.

Smart Device Elevator Calling with Occupant app API Integration: Contractor will provide an elevator calling application for smart devices (app) that can be accessed through Android and IOS smart device operating systems. This calling service shall be accomplished on both, Destination Dispatch and Traditional ETA elevator control system applications. Furthermore, a single, common and consistent app shall have the same user experience and user interface on both Destination Dispatch and Traditional ETA dispatching control systems. To enable mobile calling functionality without creating unnecessary wear on elevator components resulting from false calls, proximity detection beacons shall be installed in the elevator lobby at each floor. These beacons shall detect user smart devices and restrict calling of elevators when the user is not within a pre-configured range of elevator entrance. Beacon-based proximity detection distance must be configurable to accommodate various building and floor layouts. Once Bluetooth signal is detected, the user can place a floor call directly from their handheld or wearable device. The elevator calling app shall remove the need for interaction with hall fixtures, buttons or kiosks. This system shall be capable of placing an automatic call to a user-configured destination floor automatically based on both location in building (floor) and time of day. App users shall be able to configure their own source or starting floor, destination floor and schedule of automatic calling service, and be able to configure multiple automatic calling services and routines. System shall have reasonable ability to auto-provision users from access control system and not require duplicate entry of users for access control purposes. Finally, all services above shall be made available via an application programming interface (API) so that a 3rd party or tenant occupant app could be integrated with elevator smart device calling service so that users could receive multiple occupant experience-based services in a single, common, 3rd party mobile device application

(app).

2.10 HALL STATIONS

A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.
B. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
C. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
D. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.
C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

C. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

D. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

E. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.3 PROTECTION

A. Temporary Use: Not permitted.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate**,** adjust, and maintain elevator.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include 60 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

END OF SECTION 142123.16

Specifications for:

City of Baltimore
Department of General Services
Design and Construction Division

Contract No. PROJ 1801

Forest Park Library

Addition and Renovation

3023 Garrison Blvd.
Baltimore, Maryland 21216

PRIME AE
Trust Is Built.

100% CD Submission
February 7, 2025

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EXHIBIT ONE – GEOTECHNICAL ENGINEERING STUDY

EXHIBIT TWO - SUSPECTED HAZARDOUS AND REGULATED MATERIALS OBSERVED AND ASBESTOS SAMPLING REPORT[6]

END OF DOCUMENT 000102

[6] Addendum 2

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SECTION 210110 - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of Contract, as well as Division-22 and Division-26 sections shall apply to this Section.

1.2 SUMMARY

A. This Section specifies automatic sprinkler and standpipe systems for buildings and structures. Materials and equipment specified in this Section include:

1. Pipe, fittings, valves, and specialties;

2. Sprinklers, fire department valve cabinets, and accessories.

B. Products furnished but not installed include sprinkler head cabinet with spare sprinkler heads. Furnish to the Owner's maintenance personnel.

1.3 DEFINITIONS

A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

B. Other definitions for fire protection systems are listed in the most current edition of NFPA Standards 13, 14 and 20.

C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in the most current edition of NFPA 13 for obtaining approval of the authority having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Fire Flow Test Data:

1. Flow Hydrant:

a. Location: F3015 – Hydrant on Garrison Boulevard Baltimore, MD 21217

b. Pitot Pressure: _____PSI

c. Outlet Diameter: 2.5 Inches

d. Flow: 1097 GPM

e. Nozzle Coefficient: _____

f. Corrected Flow: _____ GPM

g. Main Size: 16 Inches

2. Residual Hydrant:

a. Location: F3015 - Hydrant on Garrison Boulevard, Baltimore, MD 21217

b. Static Pressure: 60 PSI

c. Residual Pressure: 56 PSI

d. Pitot Flow: 1097 GPM

e. Adjusted Residual Pressure w/ Pitot Flow: 56 PSI

f. Loss: _____ PSI

g. Flow at 20 PSI (140 kPa): 3803 GPM

h. Main Size: 16 Inches

3. Date of Flow Test: July 12, 2022

4. The above information is for informational purposes only. The Contractor shall provide an independent flow test to confirm flow and pressure availability.

1.5 SUBMITTALS

A. Product Data: Include each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection, fire and jockey pumps and fire department valve cabinet specified.

B. Shop Drawings: Submit drawings which have been prepared in accordance with the most current editions of NFPA, UL, FM, as well as the owner's insurance carrier requirements. Shop drawings shall include hydraulic calculations where applicable, and which have been approved by the authority having jurisdiction.

1. Sprinkler shop drawings shall be integrated into the Contractor's installation/coordination drawings.

2. Shop drawings shall include a written statement indicating compliance with all applicable requirements of NFPA, UL, FM, and the Owner's insurance carrier.

C. Coordination Drawings: Detail fire protection piping systems in accordance with Division-22 Section "Basic Plumbing Requirements." Fire protection piping shall be coordinated with work of all other trades.

D. Maintenance Data: For each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection, and fire and jockey pump, specified, include in operating and maintenance manual.

E. Quality Control Submittals:

1. Welders' qualification certificates. Submit for each qualified welder the following documentation according to AWS B2.1. Welding Procedure Specification (WPS), Procedure Qualification Record (PQR), Welder Qualification Record (WQR), verifying the AWS qualification within the previous six (6) months, or certified work history showing no break in work.

2. Test Reports and Certificates: Include "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Material & Test Certificate for Underground Piping" as described in the most current edition of NFPA 13.

3. Internal Inspection of Piping; where sprinkler piping is welded, an obstruction investigation will be conducted and report submitted.

F. Computer (CADD) files of drawings will not be made available to the Contractor for any purposes.

1.6 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

A. Use products of one manufacturer where two or more items of same kind of equipment are required.

B. Materials and equipment shall have a record of two (2) years successful field use.

C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).

D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the contractor and shall be provided at no additional cost to the owner.

E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the “Submittals” paragraph of this specification section, as well as all other requirements indicated through the Division-23 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility

of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.

F. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

G. Where items of equipment are indicated as Base Bid on the bid form include in the Bid price the cost of providing the equipment upon which the specification is based. In addition, submit with bid for Owner's consideration the amount to be added or deducted from the base bid for other listed manufacturers' equipment. Owner will advise Contractor within forty-five (45) days after award of contract of his selection.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer having a minimum of five (5) years' experience with work similar in size and scope to this project.

B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS B2.1", Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."

C. Regulatory Requirements: Comply with the requirements of the most current edition of the following codes:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.

2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

3. NFPA 20 - Standard for the Installation of Centrifugal Fire Pumps.

4. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

5. In addition to all regulatory requirements, the complete fire protection system shall meet the requirements of the Owner's insurance carrier.

D. Miscellaneous Materials:

1. Sprinkler Wrenches: Furnish to Owner, two (2) wrenches for each type of sprinkler head installed as provided by the sprinkler manufacturer.

2. Sprinkler Heads and Cabinets: Furnish six extra sprinkler heads of each style included in the project. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section.

E. Structural Certification:

1. The Sprinkler Contractor shall provide certification from a Maryland Registered Engineer that the existing building structure is capable of supporting all proposed sprinkler system piping. The certification letter must be signed and sealed prior to the submission of shop drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire protection system products which may be incorporated in the work include the following:

1. Gate Valves:
    a. Fairbanks
    b. Jenkins
    c. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.
    d. Stockham
2. Swing Check Valves:
    a. Fairbanks
    b. Jenkins
    c. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.
    d. Stockham
    e. Victaulic
    f. Reliable Automatic Sprinkler Co., Inc.
3. Grooved Mechanical Couplings:
    a. Stockham
    b. Victaulic
4. Water Flow Indicators:
    a. Reliable Automatic Sprinkler Co., Inc.
    b. Viking Corp.
5. Electric Alarm Gong:

a. Reliable Automatic Sprinkler Co., Inc.

b. Victaulic

6. Air-Pressure Maintenance Device, Dry-Pipe System:

a. Reliable Automatic Sprinkler Co., Inc.

b. Viking Corp.

c. Victaulic

7. Dry-Pipe Valves:

a. Reliable Automatic Sprinkler Co., Inc.

b. Viking Corp.

c. Victaulic

8. Detector Check Valves:

a. Ames Company, Inc.

b. Kennedy Valve, Div of ITT Grinnell Valve Co., Inc.

9. Alarm Check Valve:

a. Reliable Automatic Sprinkler Co., Inc.

b. Viking Corp.

10. Siamese Connection:

a. Guardian Fire Equipment, Inc.

b. Elkhart Brass

11. Fire Department Valve:

a. Guardian Fire Equipment, Inc.

b. Elkhart Brass

12. Sprinkler Heads:

a. Central Sprinkler Corp.

b. Johnsons Controls International

c. Reliable Automatic Sprinkler Co., Inc.

d. Viking Corp.

e. Victaulic

13. Fire and Jockey Pumps:

a. Peerless

b. ITT A-C

c. Aurora

d. MTH Pumps

2.2 PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where more than one type of materials or products are indicated, selection is Installer's option. All products in a grooved system shall be of the same manufacturer.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 section "Identification for Plumbing Piping and Equipment".

2.4 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-22 section "Pipe, Tube and Fittings for Plumbing Systems", in accordance with the following listing:

1. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 40; cast-iron threaded.

2. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 10; roll-grooved fittings.

3. Pipe Size 3” (50 mm) and Smaller: Pipe shall meet or exceed the requirements of ASTM F442 material designation CPVC 4120-06 in standard dimension ratio (SDR) 13.5. Additionally, the pipe must be marked with the following pressure ratings: “320 PSI @ 73° F”, “175 PSI @ 150° F” and “100 PSI @ 180° F”. Fittings: ASTM F438 (Sch. 40) and ASTM F439 (Sch. 80), ASTM F1970; Pipe Color – orange. FM/UL listed. All socket type joints shall be assembled with solvent cements that meet or exceed the requirements of ASTM F493. Safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be certified by NSF International for use with potable water and approved by the manufacturers. The solvent cements shall be approved for use with BlazeMaster® CPVC pipe and fittings. Use of CPVC shall be approved by local authority having jurisdiction.

4. Pipe Size 2-1/2" (65 mm) and Larger: Black steel pipe; Schedule 10; welded or grooved-end fittings, ductile iron.

5. “Weld-o-let” or “Thread-o-let” fittings shall be used for branch/runouts to sprinkler heads.

6. “U-bolt” clamps, Gruvlok clamps or socket type tees shall not be used and will not be acceptable.

2.5 BASIC VALVES

A. Gate Valves - 2 Inch (50 mm) and Smaller: Body and bonnet of cast bronze, 175 pound (1200 kPa) cold water working pressure - non-shock, threaded ends, solid wedge. outside screw and Yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open.

B. Gate Valves - 2-1/2 Inch (65 mm) and Larger: Iron body; bronze mounted, 175 pound (1200 kPa) cold water working pressure - non-shock. Valves shall have solid taper wedge; outside screw and Yoke, rising stem; flanged bonnet with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.

C. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

2.6 SPECIALTY VALVES

A. Alarm Check Valve: 300 psig (2050 kPa) working pressure, designed for horizontal or vertical installations, and have cast iron, flanged inlet and outlet, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped without valves separate from main drain line, and fill line attachment with strainer.

B. Alarm Check Valve: 300 psig (2050 kPa) working pressure, designed for horizontal or vertical installations, and have ductile iron, grooved ends, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped without valves separate from main drain line, and fill line attachment with strainer.

C. Alarm Check Valve: 300 psig (2050 kPa) working pressure, designed for horizontal or vertical installations, and have ductile iron, grooved ends, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped with check valve to main drain line, and fill line attachment with strainer.

D. Dry-Pipe Valves

1. Differential type: valve with single hinge pin and latch design with galvanized trim. Water to air seat area differential to be at least 6 to 1, capable of controlling air pressure ranging from 20 to 50 psi (1.4 to 3.4 bar). Dry pipe valve construction shall be cast iron. Dry pipe valve seat shall be of bronze construction with O-ring seals to prevent corrosion and leakage. Threaded-in, one piece air and water seat shall be removable for ease of maintenance. Clapper shall consist of ductile iron with sintered brass clapper bushings, and contain a one-piece clapper rubber facing. End connection styles to be ANSI flanged inlet and outlet in accordance with ANSI B16.1 (125 lb.), ANSI flanged inlet and grooved outlet, with grooved outlet dimensions per ANSI/AWWA C606, or grooved inlet and outlet, with grooved outlet dimensions per ANSI/AWWA C606. Dry pipe valve shall have a minimum rated working pressure of 175 psi (12.1 bar) and shall be factory hydrostatic tested at 350 psi (24.1 bar).

2. Low-pressure type: valve shall be capable of providing a 17:1 water-to-air force differential, requiring an air pressure between 10 and 26 psi (0,7 to 1,8 bar). Dry pipe valve system shall consist of a hydraulically operated differential latching clapper-type valve of lightweight, ductile-iron construction with “drop in” navy bronze seat and clapper assembly. Bronze seat shall have O-ring seals to resist corrosion and leakage. Clapper facing shall be pressure actuated, providing a limited compression seat for the sealing force between the clapper rubber facing and the valve seat. Deluge valve shall have an external reset knob for resetting the clapper without having to remove the valve face plate. Push-rod chamber design shall consist of a stainless steel piston/push-rod and spring assembly with diaphragm seal secured to the casting through a push-rod guide constructed of a synthetic engineering plastic to resist corrosion. Inlet restriction shall be built into the push-rod chamber. Casting shall have a bleeder hole located on the push-rod chamber for air/water leakage indication. End connection style to be grooved inlet and grooved outlet, per ANSI/AWWA C606. Valve and trim components shall have a rated working pressure of 250 psi (17,2 bar).

E. Air-Pressure Maintenance Device, Dry-Pipe System: An automatic device to maintain the correct air pressure in a dry-pipe system. System shall have shut-off valves to permit servicing without shutting down the sprinkler system, bypass valve for quick system filling, pressure regulator or switch to maintain system pressure, strainer; pressure ratings 14 to 60 psig (95 to 410 kPa) adjustable range, and 175 psig (1200 kPa) maximum inlet pressure. Electrical ratings shall match compressor ratings. Provide a tank mounted air compressor of size and capacity as required.

F. Automatic Air Release Valves for Fire Protection System: FM approved for 175 psig (1210 kPa) working pressure, brass construction automatic float type air vent used to reduce the amount of air trapped in a pressurized wet pipe fire system. Air vent shall be 1/2” NPT inlet with 40 mesh type strainer and 1/2” male NPT outlet to drain. Provide 1/2” ball valve and nipple. Air vent shall be Potter Model PAV. Drain shall be extended to nearest storm water piping with backwater valve.

G. Detector Check Valves: Galvanized cast iron body, with a bolted cover with air bleed device for access to internal parts; 175 psig (1200 kPa) working pressure. One piece bronze disc with bronze bushings, pivot and replaceable seat. Provide threaded bypass taps in the inlet and outlet for bypass meter connection. Valve shall be set to allow minimal water flow through the bypass meter; when major water flow is required, the water pressure will fully open the clapper.

H. Air Supply for Dry-Pipe Systems:

1. Air Compressor: A tank-mounted air compressor with associated pressure switch and check valve. Compressor shall be selected from those available from manufacturer and listed with unit based upon system size. Motor size, voltage, and other electrical characteristics shall be coordinated with electrical subcontractor. Air supply shall be regulated by an approved regulating type air maintenance device containing a field adjustable regulator having a range of 5 to 100 psi (.34 to 6,9 bar), a check valve, strainer, and a rapid fill valve.

2.7 AUTOMATIC SPRINKLERS

A. Sprinkler Heads: Fusible link or glass bulb type, and style as indicated or required by the application. All heads shall be UL Listed/FM Approved. For each application, all heads shall be of the same manufacturer. Unless otherwise indicated, provide heads with nominal 1/2 inch (13 mm) discharge orifice, for "Ordinary" temperature range.

B. Sprinkler Head Finishes: Provide heads with the following finishes:

1. Upright or Pendent Styles: Standard bronze finish for heads in unfinished spaces and not exposed to view. Heads shall be wax-coated where installed exposed to acids, chemicals, or other corrosive fumes.

2. Recessed Ceiling and Sidewall Styles: Bright chrome, with [bright chrome] [painted white] escutcheon plate.

3. Concealed Style: Rough brass and painted white cover, screwed-on adjustment plate.

4. Residential Style: White with matching escutcheon plate.

5. Intermediate Level Style: Bright chrome.

6. Extended Coverage: bright chrome.

7. For dry pipe systems in garage area, provide dry upright sprinkler heads.

C. Provide quick response sprinkler heads throughout the building.

D. Provide high temperature sprinkler heads in equipment spaces where pressure and temperature relief valve(s) are to be installed.

E. For fire pump applications, all sprinkler heads shall be 250 psi (1710 kPa).

F. Sprinkler Head Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for six (6) spare sprinkler heads plus sprinkler head wrench. Provide a separate cabinet for each style sprinkler head on the project.

2.8 FIRE DEPARTMENT VALVE

A. Fire Department valve shall be a 2-1/2" (65 mm) polished brass pressure reducing device capable of handling inlet pressures up to 300 psi (2040 kPa).

B. Valve shall be complete with removable 2-1/2" x 1-1/2" (65 mm x 40 mm) reducer, cap and chain.

2.9 SIAMESE CONNECTIONS

A. Wall Type Siamese Connections: Polished cast brass, flush wall type, with wall escutcheon and two-way connections. Connection sizes shall be 4 inch (100 mm) outlet and two 2-1/2 inch (65 mm) female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA. Each inlet shall have a clapper valve, and plug and chain. Unit shall have wall escutcheon of cast brass, finish to match connections, with words "AUTO SPKR & STANDPIPE" in raised letters.

2.10 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type waterflow detector, rated to 250 psig (1724 kPa); designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 2.5 ampere 24 Volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed.

C. Electric Alarm Gongs: 10 inch (250 mm) diameter cast aluminum gong, with factory-finish in red enamel; bell shall be weatherproof and listed for outdoor use by Underwriters Laboratories and Factory Mutual. Power supply shall be compatible with fire alarm control panel. Alarm bell shall be motor driven with under dome striker.

D. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position.

2.11 FIRE PUMP

A. Fire Pump - Electric Motor Driven:

1. Furnish and install where shown on the drawings, Fire Pump System complete with pump, electric driver, controller and all related accessories. The pump unit shall be UL listed -- FM approved. The pumping unit shall meet all requirements of NFPA Standard 20. The fire pump shall be of capacity as indicated on the drawings. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65% rated pressure. The shut off pressure shall not exceed 120% of rated pressure. The pump shall operate at a maximum speed of not less 3560 RPM.

2. The fire pump shall be a horizontal base mounted, split case, bronze fitted, single stage, double suction centrifugal unit, or vertical in-line type, as indicated on the drawings.

3. The electric driver shall be a horizontal mounted, open drip proof ball bearing type, AC induction squirrel cage motor, wound for 460 volts-3 phase-60 cycles. Locked rotor currant shall not exceed the values specified in NFPA Standard 20.

4. Casing shall be of cast iron having a minimum tensile strength of 35,000 pounds. Bearing housing supports, suction and discharge flanges shall be integrally cast with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges.

5. Impellers shall be of the enclosed type of vacuum cast bronze. Impellers shall be dynamically balanced, keyed to the drive shaft and held in place with threaded shaft sleeves.

6. The fire pump shaft shall be made of SAE 1045 steel or equal, accurately machined to give a true running rotating element. The shaft shall be protected by bronze sleeves which shall be key locked and threaded so that the sleeves tighten with the rotation of the shaft. A gasket shall seal between the impeller hub and the shaft to protect the pump shaft.

7. The fire pump shall be equipped with renewable casing rings so designed that hydraulic pressure will seat the rings against a shoulder in the pump case around the full periphery of the wearing ring. The wearing ring will be locked by dowling to prevent rotating. The rotating element shall use heavy duty grease lubricated ball bearings and shall be equipped with water slingers. Bearing housings shall be so designed to flush the lubricant through the bearing.

8. All packed pumps shall be provided with a lantern ring connected to the pressure side of the fire pump by cored passage in the parting flange of the pump. Stuffing boxes shall be equipped with split packing glands designed for the easy removal for packing inspection and maintenance.

9. The fire pumping unit shall include the following accessories:

    a. Eccentric tapered suction reducer

    b. Concentric tapered discharge increaser

    c. Coupling guard

    d. Hose valves

    e. Caps and chains

    f. Hose valve header

    g. Pressure gauges

    h. Circulation relief valve

i. Automatic air release valve

j. Ball drip valve

10. The fire pump motor shall be completely assembled, wired and tested by the manufacturer before shipment from the factory. The fire pump, controller(s) and all accessories shall be purchased under a unit contract. The pump shall be given a complete performance test with Positive Suction Pressure. Certified performance curves for both conditions shall be prepared and submitted for approval prior to shipment. The pump shall also be hydrostatically tested to twice the shutoff pressure, but in no case less than 250 psi.

11. The fire pump manufacturer shall assume unit responsibility and shall provide the services of a factory trained engineer to supervise the fire pump installation and also be available to conduct final field testing and acceptance.

2.12 FIRE PUMP CONTROLLER

A. The fire pump controller shall be of the combined manual/automatic type equipped with a solid state soft start starter. The controller shall be a completely factory assembled, wired unit, specifically meeting the requirements of NFPA Standard 20 and the National Electrical Code. The controller shall be UL listed and FM approved and supplied in a NEMA Type 3R enclosure. The fire pump controller shall be tested by the manufacturer before shipment from the factory and shall be identified as A Fire Pump Controller.

B. Limited-service controllers are not permitted.

C. Provide minimum run timer to prevent short cycling.

D. The fire pump controller shall be provided with digital readouts of the voltage of each phase, amperage of each phase, and frequency.

E. The fire pump controller shall monitor [isolation switch open on secondary source, secondary source operation,] fire pump running, loss of phase or line power, and phase reversal. Alarms shall be individually displayed on the front of the fire pump controller by lighting of visual lamps. The fire pump controller shall be equipped with terminals for remote monitoring of secondary power operation, pump running, loss of power and phase reversal.

F. The fire pump controller shall be provided with voltage surge arrestors installed in accordance with NFPA 20.

G. The fire pump controller shall be equipped with an USB port for information download. The controller shall be provided with a minimum 3,000 events recorder.

H. The fire pump controller shall be equipped with an integral automatic transfer switch. The automatic transfer switch shall be factory assembled and packaged as a unit with the fire pump controller. See specification section 263600 for additional automatic transfer switch requirements.

I. The controller shall have both an isolating switch and a circuit breaker that are motor rated and capable of interrupting the motor locked rotor current. The isolation switch and

circuit breaker assembly shall be mechanically interlocked to operate with a single externally operated handle, with the enclosure door open or closed. The operating assembly shall also be mechanically interlocked to the enclosure door.

J. The circuit shall be of a type to accommodate a short circuit potential of not less than 100,000 amperes RMS at [208 volts]. The circuit breaker trip functions shall be self-contained within the circuit breaker case and not require additional current transformers or voltage sources to accomplish the trip function. The breaker trip curve adjustments shall be capable of being field tested to verify actual pick-up, locked rotor, and instantaneous trip points, after field installation, without disturbing line or load wiring.

K. The complete assembly shall be listed for fire pump service.

L. An emergency power disconnect/isolating switch shall be furnished, motor horsepower rated and capable of interrupting the motor locked rotor current. The switch shall be mechanically interlocked with the enclosure door, and operated by a single externally operated handle with the enclosure door open or closed. An auxiliary contact from the switch shall be provided to prevent starting of the emergency generator when the main fire pump controller is being serviced.

M. The controller shall have a front mounted "Power On" pilot light, a "Start" and "Stop" push-button, and an "Emergency Run" mechanism. The "Power On" pilot light shall indicate loss of control transformer power as well as line power. An FTA200C factory built-in alarm system shall be provided, giving an audible alarm for "Pump Running" or "Power Failure", and a visual alarm for "Supervisory Power Failure". Additional power failure and pump running alarm contacts shall also be wired to terminals for remote alarm in central fire alarm panel provided by Division-26.

N. A pressure switch shall be provided and shall be adjustable. The combined pressure settings, and a minimum differential of 6 psi. A minimum running period timer shall be provided.

O. Where required by the Owner’s insurance carrier, the controller shall be configured for manual shut-down only. The contractor shall verify the requirement and configure the controller accordingly.

P. The fire pump controller shall be manufactured by Master, Firetrol or Sylvania.

2.13 JOCKEY (MAKE-UP) PUMP

A. Pump shall have minimum capacity and electrical characteristics as follows: 5 to 8 GPM, 178 psi and 208 volt, 3 phase.

B. Pump shall be equipped with mechanical seals and open drip proof motor.

C. Control panel in a NEMA 3R enclosure, shall include fusible disconnect switch, magnetic A-T-L starter, control transformer, H-O-A selector switch, pilot light and necessary circuitry to provide automatic start and stop from pressure switch; pressure relief valve and pressure gauges shall be provided in system.

2.14 PRESSURE SENSING LINE

A. The fire pump controller and jockey pump controller shall be provided with completely separate pressure sensing lines in accordance with NFPA 20.

2.15 BACKFLOW PREVENTER (FIRE PROTECTION)

A. Provide double check detector assembly consisting of two independently operated check valves, two resilient wedge gate valves and bypass assembly. Working pressure shall be a minimum of 175 psi (1200 kPa). Flange dimension shall be in accordance with AWWA Class D. The entire assembly, including shutoff valves, shall be UL, FM, and ASSE approved.

B. Where hydraulic calculations require a reduction in system pressure loss to meet desired conditions, size of backflow preventer shall be increased as required to reduce system losses. Backflow preventer size shall not be less than the connected line size indicated.

C. Backflow preventer assembly shall be an AMES 3000 SS (Silver Bullet) or equivalent. Pressure losses shall not exceed the documented flow characteristics of the AMES 3000 SS.

D. Contractor shall verify code compliance of a double check assembly versus a reduced pressure principle backflow preventer. Should the local authority require a reduced pressure type, the reduced pressure assembly shall be AMES 3000 SS or equivalent.

E. Backflow preventer shall be installed by a certified plumbing contractor in accordance with the local plumbing authority.

F. Backflow preventer shall be supplied and installed with a Howard County owned and supplied bypass meter. Refer to Howard County, Maryland Department of Public Works, Inside Combined Fire/Domestic Water Meter Detail for more information.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, installation of piping shall leave adequate space for work of all other trades.

1. Deviations from approved "Working Plans" for sprinkler piping require written approval of the authority having jurisdiction. Written approval shall be on file with the Architect prior to deviating from the approved "Working Plans."

B. Install sprinkler piping to provide for system drainage in accordance with the most current edition of NFPA 13.

C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Branch takeoffs to sprinkler heads shall occur from the top of sprinkler branch piping.

D. Install unions in pipes 2 inch (50 mm) and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using roll-grooved mechanical couplings.

E. Install flanges on valves, apparatus, and equipment having 2-1/2 inch (65 mm) and larger connections, unless ductile iron with grooved ends.

F. Hangers and Supports: In addition to the requirements specified in the Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment," comply with the requirements of the most current editions of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with roll-grooved mechanical couplings shall be in accordance with the roll-grooved mechanical coupling manufacturer's written instructions, for rigid systems. Provide protection from damage where subject to earthquake in accordance with the most current edition of NFPA 13.

G. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

H. Provide mechanical sleeve seals at pipe penetrations in basement and foundation walls and penetration seals at openings in fire rated walls, floors and ceilings. Refer to Division-22 Section "Piping Specialties for Plumbing Systems" for description and installation requirements.

I. Install test connections sized and located in accordance with the most current edition of NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes.

J. Install pressure gage on the riser or feed main at or near each test connection. Provide gage with a connection not less than 1/4 inch (6 mm) and having a soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and where they will not be subject to freezing.

K. Piping passing through areas exposed to freezing conditions shall be protected against freezing by insulated coverings, frostproof casings or other reliable means capable of maintaining a minimum temperature of 40°F (4°C). All sprinkler piping, heads, fittings, etc. shall be installed on "warm" side of insulation. Insulation shall be tight with no open joints. Piping shall not touch or be run immediately adjacent to building structural steel. Prior to installing piping in areas exposed to freezing, the contractor shall notify the architect or owner's representative.

3.2 PIPE JOINTS

A. Welded Joints: AWS B2.1, Level AR-3.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

2. Align threads at point of assembly.

3. Apply appropriate tape or thread compound to the external pipe threads.

4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.

5. Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

D. Mechanical Roll-Grooved Joints: Roll grooves on pipe ends dimensionally compatible with the couplings.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.3 VALVE INSTALLATIONS

A. General: Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, the most current editions of NFPA 13 and 14, and the authority having jurisdiction.

B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division-22 Section "Identification for Plumbing Piping and Equipment" for valve tags and signs.

C. Install check valves in each water supply connection.

D. Alarm Check Valves: Install valves in the vertical position, or horizontal if allowed by manufacturer in proper direction of flow including the bypass check valve and retard chamber drain line connection. Install valve trim in accordance with the valve manufacturer's appropriate trim diagram. Test valve for proper operation.

E. Dry-Pipe Valves: Install in the vertical position, or horizontal if allowed by manufacturer in proper direction of flow, in the main supply to the dry-pipe system. Install the basic trim set, priming chamber attachment and fill line attachment in accordance with the manufacturer's written instructions. During hydrostatic test of system piping at pressures in excess of 50 psi, position the clapper in latched wide open position or removed from valve, to prevent injury to the valve. Test valve for proper operation.

F. Detector Check Valves: Install in proper direction of flow in a location to detect system leakage and unauthorized use of water, and to prevent backflow into public water mains. Install bypass meter, with gate valves on each side of the meter to permit meter removal, and check valve downstream from the meter.

G. Fire Department Valves: Install 2-1/2 inch (65 mm) fire department valves with quick-disconnect 2-1/2 to 1-1/2 inch (65 mm to 40 mm) reducing coupling and flow restriction device at each standpipe outlet for hose connections.

H. Siamese Installations:

1. Install automatic drip valves at the check valve on the fire department connection to the mains.

2. Install mechanical sleeve seal at pipe penetration in outside walls.

3.4 SPRINKLER HEAD INSTALLATIONS

A. In areas with acoustical tile ceilings, sprinkler heads shall be installed in the center of the ceiling grid.

B. Use manufacturer supplied tools to prevent damage during installations and as required to maintain UL Listing/FM Approval.

C. Sprinkler Heads: Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2 inch (13 mm) discharge orifice, for "Ordinary" temperature range.

D. Provide high temperature sprinkler heads in equipment spaces where pressure and temperature relief valve(s) are to be installed.

E. Provide quick response sprinkler heads throughout the building.

F. For fire pump applications, all sprinkler heads shall be 250 psi (1710 kPa).

G. Provide NFPA approved sprinkler head guards in all areas subject to potential damage. Sprinkler head guards shall be provided in the following areas and other similar type spaces subject to potential damage: multi-purpose rooms, fitness areas, activity rooms, mechanical rooms, electrical rooms, etc.

3.5 BACKFLOW PREVENTER

A. Install backflow preventer assemblies in accordance with UL, FM, and ASSE standards, as well as the local plumbing code and the local fire protection authority having jurisdiction.

3.6 FIRE PUMP AND JOCKEY PUMP CONTROLLER

A. Install fire pump controller and jockey pump controller as required by NFPA 20 and NFPA 70.

B. For emergency generator applications, control conductors installed between the transfer switch and the generator shall be as follows:

1. Control wire installation shall comply with NEC Article 695.14 (F).

2. The control conductors shall be kept entirely independent of all other wiring and shall meet the conditions of NEC Article 695.14 (F).

3. The integrity of the generator remote start circuit shall be monitored for broken, disconnected, or shorted wires. Loss of integrity shall start the generator(s).

3.7 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with the most current edition of NFPA 13.

B. Flush, test, and inspect standpipe systems in accordance with the most current edition of NFPA 14.

C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION 210110

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SECTION 22 01 00 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Plumbing Divisions.

B. Contract drawings for plumbing work are diagrammatic, intended to convey scope and general arrangement. Contractor shall review and coordinate routing of new work to clear existing piping, electrical, structure, etc. at no cost to the Owner. All dimensions of existing conditions shall be considered approximate (for information only). All dimensions shall be verified prior to construction.

C. Contract Document Interpretation/Discrepancies:

1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.

2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.

3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.

4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Information Technology, etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.

D. The complete set of Architectural, Structural, Civil, Mechanical, and Electrical drawings and specifications apply to this work.

1.2 SCOPE

A. The work in Division-22 includes furnishing and installing the plumbing systems complete and ready for satisfactory service.

B. Requirements specified govern work in all sections of Division-22.

1.3 REFERENCES

A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.

B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.

C. Refer to Division-01 for description of alternates.

D. Refer to Division-01 for description of allowance items.

E. Refer to Division-01 for description of base bid items.

1.4 DEFINITIONS

A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.

2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.

3. "Directed" - directed by Engineer.

4. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.

5. "Exposed" - not concealed.

6. "Indicated" - indicated in Contract Documents.

7. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.

8. "Provide" - furnish and install.

9. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.

10. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements.

Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.

11. “Appurtenances” - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventers, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.

12. “Record Documents” - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer’s approval and without voiding warranties and/or certifications, have the equipment “broken down” into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.

B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all plumbing piping, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides and fire protection coordinated with each other and with the structure. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any plumbing equipment.

B. Should the Contractor not provide the coordinated installation drawings required above, the following shall apply:

1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.

2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.

3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.

C. Computer (CADD) files of mechanical drawings (HVAC, plumbing, etc.) will not be made available to the Contractor for use in the preparation of coordinated drawings, shop drawings or any other use.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

A. Use products of one manufacturer where two or more items of same kind of equipment are required.

B. Materials and equipment shall have a record of two (2) years successful field use.

C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).

D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the contractor and shall be provided at no additional cost to the owner.

E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the “Submittals” paragraph of this specification section, as well as all other requirements indicated through the Division-22 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.

F. Nameplate: For each piece of power operated plumbing equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

G. Where items of equipment are indicated as Base Bid on the bid form include in the Bid price the cost of providing the equipment upon which the specification is based. In addition, submit with bid for Owner's consideration the amount to be added or deducted from the base bid for other listed manufacturers' equipment. Owner will advise Contractor within forty-five (45) days after award of contract of his selection.

1.8 MATERIAL AND EQUIPMENT LIST

A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.

D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.

G. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The contractor will be responsible to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The contractor must fulfill the terms of the contract.

H. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:

1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.

2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:

   a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.

   b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

   c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

I. Electronic Submittals: Should the contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:

1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the contractor’s review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.

2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.

3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.

4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.

5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.

6. Failure to comply with the above will result in the submittal being returned and marked “Not Reviewed”.

J. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.

K. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.

L. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.

1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor’s responsibility to submit the appropriate materials in a timely fashion.

2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.

M. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.

2. Indicate name of firm or entity that prepared each submittal on label or title block.

3. Provide a space approximately 4 by 5 inches on label or beside title block to record contractor’s review and approval markings and action taken by A/E.

4. Include the following information on label for processing and recording action taken:

a. Project name

b. Date

c. Name and address of A/E

d. Name and address of contractor

e. Name and address of subcontractor

f. Name and address of supplier

g. Name of manufacturer

h. Unique identifier, including revision number

i. Number and title of appropriate specification section

j. Drawing number and detail references, as appropriate

k. Other necessary identification

l. Example: 220700-01-0

1) 220700 references the spec section

2) 01 indicates this is the first submittal from this spec section

3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

N. The engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned "Not Acceptable" or "Revise and Resubmit", the contractor shall choose one of the following courses of action:

1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or

2. Reimburse the engineer for all additional review time required to achieve a submittal review from the engineer of "No Exceptions Taken."

3. Should the contractor choose option 2 above, the engineer shall be reimbursed at an hourly rate of $175 per hour with payment due prior to the return of the final submittal. In addition, the contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

O. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.

1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual "C", "D", or "E" as follows:

a. "C" shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.

b. "D" shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

c. "E" shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.

B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 SITE EXAMINATION/EXISTING CONDITIONS VERIFICATION

A. Failure to visit site and become familiar with existing conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract documents.

B. Contractor shall field verify existing services and direction of flow of piping prior to connection. Existing plumbing identification shall not constitute proper verification of service or direction of flow.

1.15 REGULATIONS AND PERMITS

A. Comply with all applicable codes and regulations.

B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.

C. Obtain and pay for all required permits.

1.16 UTILITY CONNECTIONS

A. Area connection charges for water and sewers will be paid by the Owner.

B. Application for water meter will be made by the Owner.

C. Contractor shall include an allowance as identified in Division-01 for providing water meter, vault, and connection to main by Bureau of Water Supply.

D. Gas Service: Arrange for installation of gas meter and connection to main by gas utility. Pay charges, if required. Gas main extension charges, if any, will be paid by the Owner.

1. All gas installations on and at the Owner's property/building must conform to BGE's construction and installation requirements. Gas meter installation requirements shall include, but not be limited to, the following:

a. Meters shall not be installed within three feet (900 mm) of any equipment with an open flame or subject to electric arcing.

b. Meters shall not be installed in areas where the clearance from the front of the meter to an opposite wall is less than two feet (600 mm).

c. Gas meters shall be installed such that there are four feet (1200 mm) of clearance from the front of the meter to a wall directly opposite where an electric meter is located.

d. Outside meters shall not be installed within three feet (900 mm) of an opening used for ventilation.

e. Meters shall not be installed in unventilated spaces.

f. Meters shall not be installed in places where they may be subject to damage (driveways, sidewalks, etc.) unless suitable traffic protection is provided.

g. Contractor shall provide a concrete pad for installation of the gas meter. Pad requirements shall be as required by the gas utility company.

2. Gas conduit installation requirements shall be as follows:

a. The following gas conduit specification is acceptable for use on BGE system: UL Schedule 40 DB 60.

b. Conduit for gas services (not mains) is required whenever installed in common with electric ducts.

c. Gas conduit shall not exceed one 45-degree (.785 Radians) bend, and must be terminated a minimum of five feet (1500 mm) from all buildings/structures. No 90-degree (1.57 Radians) bends are permitted.

d. Only one gas service per conduit is permitted.

e. Gas conduits will be concrete-encased.

f. Installation of gas piping into electrical conduit bank is prohibited.

g. PVC conduit (minimum 4") (minimum 100 mm), solid wall, not split) may be used as a sleeve installed in advance of paving to facilitate future installation of small size (2" and smaller) (50 mm and smaller) gas services where casing is not required. The ends of the sleeve should not be sealed after insertion of the carrier pipe to avoid containment of gas in case of a gas leak. However, the end of the sleeve on a service line nearest the building should be sealed after installation of the carrier pipe and the opposite end of the sleeve left open.

h. Lengths of continuous runs for gas ducts shall not exceed 450 feet (135 m).

i. Mechanical joints on gas services are not allowed inside of conduit. Open trench space provision must be made to allow BGE room to make these connections.

j. Marker tape is required, and must be 12" (300 mm) minimum above all gas conduits.

k. Required minimum depth of conduits from final grade to top of conduit is 24" (600 mm).

l. Required vertical separation for gas conduit crossing foreign structures is 12" (300 mm).

m. Horizontal separation between gas conduit and electric conduit, in common trench, should be 12" (300 mm) minimum.

1.17 CUTTING AND PATCHING

A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.

B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.

C. In precast concrete plank drill all holes with a Carboloy tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.18 LINTELS

A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical and plumbing work. Lintels shall meet the requirements of the structural sections.

1.19 CLEANING UP

A. Keep premises free from accumulation of debris.

B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.

C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.

D. Leave all areas broom clean.

E. Final clean-up shall be performed.

1.20 AREAS REQUIRING SPECIAL FINISHES/PAINTING

A. In kitchens, cafeterias, dining rooms, serving pantries and utility rooms [polish chromium or nickel plate] [paint as specified under Painting] all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.

B. Provide surface preparation, priming and painting of all mechanical room floors to provide a smooth, cleanable surface. Primer and paint shall be appropriate for concrete slab surfaces. Where painting over existing surfaces or coatings, follow manufacturer's recommendations for surface preparation, priming and painting. Architectural section "Painting" shall govern the painting installation. Color shall be selected by Architect.

1.21 PROTECTION

A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect fixtures as soon as they are set. Board over water closets and post notices prohibiting their use.

B. Cap or plug openings in equipment, piping and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.

C. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.

D. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75˚F (+2˚F) and 50% RH (+5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the owner accepts occupancy of the building.

1.22 PIPE TESTING

A. Prior to the balancing of systems, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a. Air, Gas

2. Hydrostatic Test:

a. Domestic Water

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is four (4) hours.

2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.

3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than one percent (1.0%) of test pressure.

4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.

5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

D. Air Test:

1. Air, gas piping shall be air tested at 200 psi (1380 kPa).

2. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

E. Sanitary and Storm Water Piping Systems:

1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.

2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

F. Drain test water from piping systems after testing and repair work has been completed.

G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

1.23 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.

B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.

C. Leave strainers and dirt pockets in clean condition.

D. Should any system become clogged with construction refuse after acceptance, the contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.

E. Thoroughly clean plumbing fixture using non-scratching cleaners. Polish chromium plated work.

F. Leave all systems clean, and in complete running order.

G. Disinfect potable water systems as prescribed by local code. Take precautions to avoid use of fixtures during disinfection period.

H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.24 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic Plumbing Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

1.25 OPERATING AND MAINTENANCE MANUAL

A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.

B. At a minimum, the manual shall contain the following:

1. Title page

2. Table of contents

3. Contractor and sub-contractor contact information

4. Supplier contact information for all plumbing equipment

5. Copies of manufacturer's and contractor's warranty information (project and equipment) for all plumbing equipment.

6. Submittal log for all plumbing equipment

7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.

8. Copy of inspector acceptance certificates / documents.

9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of system shutoff valves.

10. All pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.

11. Maintenance procedures for each item of plumbing equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.

12. Valve tag chart

13. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

C. The O & M Manuals shall be submitted to the A/E for review of general conformance.

1.26 TOOLS AND LUBRICANTS

A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.

D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.27 FIELD INSTRUCTION

A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the plumbing and electrical systems.

B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.

C. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than . one . eight hour days.

D. Prepare statement(s) for signing by Owner's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to Engineer.

E. Final demonstration of all plumbing equipment shall be recorded in DVD compatible format. Provide DVD’s to the Owner.

1.28 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of plumbing prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner’s FTP site. The final CADD documents shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format

shall be compatible with the owner's preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.

D. Computer (CADD) files of plumbing drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.29 LEAD FREE COMPLIANCE

A. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.30 GUARANTEE/WARRANTY

A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.

C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

1.31 PIPING LEAKAGE TEST FORMS

A. Contractor shall submit piping leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Piping test results shall be recorded on the "Piping Leakage Test Summary Form (Plumbing)" located at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the piping test section (each piping test section shall be numbered and color coded).

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 22 01 00

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PIPING LEAKAGE TEST SUMMARY FORM

(PLUMBING)

Project Name: _____ Project Number: _____ Page ____ of ____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____
Date of Test(s): _____
Test Conducted By (Print/Sign): _____

(1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
(2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas-vacuum, 10 ft. static head pressure or to the maximum rating of the joint. Include joint cut sheets showing their ratings.
(3) Four (4) hours minimum.
(4) Shall not exceed 0.0%.

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SECTION 22 02 00 - PROJECT CLOSEOUT PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides a summary of the primary mechanical project closeout activities, however, this section does not attempt to address all project closeout requirements. Closeout activities referenced in this section include the following:

1. Pressure Testing
2. Start-up
3. Punch-out Procedures
4. Testing, Adjusting and Balancing
5. Functional Performance Testing and Verification
6. Operation and Maintenance Manuals (O & M Manuals)
7. Demonstration and Training
8. Record Documents
9. Close-out Documents

B. This Section shall not supersede any other close-out section or requirements of the Contract. Refer to other Divisions of the specifications and the General Requirements of the Contract for further instructions.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 PRESSURE TESTING

A. Piping: The Contractor shall perform pressure testing on all piping systems.

B. Final pressure test results shall be submitted as a separate project submittal for review and included with the Test and Balance Report. Upon review for general conformance, include all pressure tests in the O & M Manual.

C. All factory performed equipment test results shall be included in the final O & M Manuals.

D. Where re-tests were required, indicate remedial action taken and submit in test report.

3.2 START-UP

A. The Contractor shall perform start-up on each piece of mechanical equipment as specified in each section of Division-22.

B. Where indicated in each section of Division-22, the services of a factory authorized and certified technician shall be required to perform the equipment start-up. Start-up by any other organization other than as required by the manufacturer is unacceptable.

C. Start-up reports shall be provided for all equipment and be included in the final O & M Manuals.

3.3 PUNCH-OUT PROCEDURES

A. Preliminary Punch-out:

1. Prior to requesting an inspection from the Owner, Engineer, or Permit Official, the General Contractor or Construction Manager (GC or CM) shall provide a preliminary punch-out of the area in question.

2. Once completed, their punch list shall be supplied to each trade for corrections and completion. The punch list shall also be provided to the Engineer for their use.

3. Upon being informed that the trade contractors have addressed all of the outstanding items, the GC / CM shall backcheck the work and update the punch list.

B. Final Punch-out:

1. Final punch-out by the engineer shall not commence until the GC or CM has exhausted their review and has signed off on all items.

2. A copy of the sign-off shall be provided to the Engineer for their record.

3. Once the above has been completed, the Engineer shall be notified that the work is substantially complete and ready for a final punch-out.

4. Depending on the size, schedule, and project complexity, punch-outs may be requested for specific areas or systems, rather than the facility as a whole. Examples of specific requests include the following:

a. Above ceiling

b. Mock-ups for any repetitive installation to confirm acceptance prior to continuing (apartment, etc.)

c. Equipment rooms

C. Upon completion of any and all punch lists (i.e. above ceiling, final, partial, phased, factory review, or specific item) the contractor shall provide an item by item sign-off indicating the date and who completed the item. The sign-off shall be submitted to the A/E and owner before final payment is processed. Should the contractor disagree with any item, they shall provide a written exception giving reason for review.

3.4 TESTING, ADJUSTING AND BALANCING

A. Comply with all provisions of Division-23 Section, “Testing, Adjusting and Balancing” (TAB) for the systems listed, but not limited to, the following:

1. Domestic hot water recirc pump and associated balance valves

B. TAB reports shall be submitted as a separate project submittal for review. Upon review for general conformance, include the final TAB report in the O & M Manual.

3.5 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic Plumbing Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been

submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals in three-ring binders with each section separated by tab dividers. Include protective plastic sleeves for any software or folded large documents submitted.

B. At a minimum, the manual shall contain the following:

1. Title page

2. Table of contents

3. Contractor and sub-contractor contact information

4. Supplier contact information for all mechanical equipment

5. Copies of manufacturer's and contractor's warranty information (project and equipment) for all mechanical equipment.

6. Submittal log for all mechanical equipment

7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and owner submittal review comments.

8. Copy of inspector acceptance certificates / documents.

9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of system shutoff valves.

10. All pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.

11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.

12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer's literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.

13. Valve tag chart

14. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

C. The O & M Manuals shall be submitted to the A/E for review of general conformance.

3.7 DEMONSTRATION AND TRAINING

A. Upon completion of work, instruct the owner's representative in the proper operation and maintenance of each mechanical system in accordance with applicable specification sections.

B. Instructions shall be given by persons expert in the operation and maintenance of each system / equipment.

C. Prepare statement(s) for signing by Owner's representative indicating the date of completion of instructions and hours expended. Furnish copies of signed statements to the A/E.

D. Final demonstration of all mechanical equipment shall be recorded in DVD compatible format. Provide DVDs to the Owner.

3.8 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of plumbing prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in electronic CADD format. One (1) set of full size prints, one (1) CD of the electronic CADD drawings (in AutoCad and pdf format), along with the red-lined marked up field set shall be delivered to the owner upon completion. If requested, the electronic CADD documents shall be up-loaded to the owner’s FTP site. The final CADD documents shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format shall be compatible with the owner’s preferred version of AutoCad. Coordinate with the owner before producing the CD or up-loading to the FTP site. Not acceptable are contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.

D. Computer (CADD) files of plumbing drawings will be made available to the Contractor upon receipt of a signed waiver (available upon request). One CD will be made available to the general contractor or construction manager for distribution to the trades.

E. Should the Contractor’s electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

3.9 CLOSEOUT DOCUMENTS

A. Prior to Substantial Completion and /or Final Payment, the Contractor shall prepare and submit the following:

1. Final punch lists indicating completion of all items
2. All record drawings
3. All record specifications
4. Operation and Maintenance Manuals
5. Complete final cleaning
6. Remove temporary facilities and complete site restoration

END OF SECTION 22 02 00

SECTION 22 05 00 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

B. Requirements specified in all Division-22 sections apply to this Section.

1.2 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.

2. Firestopping: Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, conduit, etc.

3. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment up to five (5) feet (1500 mm) outside the building.

4. Miscellaneous metals for support of mechanical materials and equipment.

5. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.

6. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

7. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.

3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

B. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.

4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.

6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.

B. Product data for the following products:

1. Access panels and doors

2. Joint sealers

C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.

1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.

2. Provide drawings relating to non-standard applications as needed.

D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations in accordance with Division-22 sections.

F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

C. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

E. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.

F. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be "lead-free" in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61- G).

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by selective demolition.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

4. Existing Utilities: Locate existing underground utilities in excavation areas prior to excavation. If utilities are indicated to remain, support and protect services during excavation operations.

5. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.

6. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect prior to utility interruption.

7. Use of explosives is not permitted.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

1.8 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.

B. Notify the Architect at least five (5) days prior to commencing demolition operations.

C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

A. All penetrations through fire barriers shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier. All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.

B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, cable trays, conduit, and cables.

C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.

D. Acceptable products shall be limited to Johns Manville “Firetemp-C1;” Hilti “FS-One;” or 3M “CP25WB+.” Coordinate with General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.3 SMOKE STOPPING

A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.

B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.02 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch (40 mm) sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches (150 mm) in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.5 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.6 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.7 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.

2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and

nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.8 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.

2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.

3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks. [Common use]

E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. [Secured areas only: note as such].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than four inches (100 mm) in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

D. Protect materials from damage on surface subject to traffic.

E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.

F. Where large openings are created in walls or floors to permit installation of pipes, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.

G. Install smoke stopping as specified for firestopping.

H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch (300 mm) wide fiber dams for full thickness and height of air cavity at maximum 15 foot (4500 mm) intervals.

3.3 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches (750 mm) below finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.

2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot (30 mm); plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch (25 mm) in diameter and larger with emulsified asphalt tree paint.

2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

G. Trenching: Excavate trenches for mechanical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches (150 to 225 mm) clearance on both sides of pipe and equipment.

2. Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.

3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.

4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches (150 mm) of stone or gravel cushion between rock bearing surface and pipe.

5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.

6. For pipes or equipment 6 inches (150 mm) or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (2 degrees C).

I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.

2. Under building slabs, use drainage fill materials.

3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.

4. For piping less than 30 inches (750 mm) below surface of roadways, provide 4-inch (100 mm) thick concrete base slab support. After installation and testing of piping, provide a 4-inch (100 mm) thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.

5. In other areas, use excavated or borrowed materials.

J. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.

2. Removal of concrete formwork.

3. Removal of shoring and bracing, and backfilling of voids.

4. Removal of trash and debris.

K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches (200 mm) in loose depth for material compacted by heavy equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them approximately to same elevation in each lift.

N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

2. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches (300 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

3. Areas Under Walkways: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

4. Other Areas: Compact top 6 inches (150 mm) of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

5. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

O. Subsidence: Where subsidence occurs at mechanical installation excavations during the period twelve (12) months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

2. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.8 INSTALLATION OF ACCESS DOORS

A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, etc.

B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 22 05 00

SECTION 22 05 13 - ELECTRICAL PROVISIONS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Types of work normally recognized as electrical, but provided as mechanical, specified or partially specified in this section, include but are not necessarily limited to the following:

1. Motors for mechanical equipment.

2. Motor starters and Variable Frequency Drives (VFDs) for mechanical equipment.

3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.

4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.

B. Refer to requirements of Division-26 sections.

1.2 QUALITY ASSURANCE

A. Coordination with electrical work: wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in division-26 sections for electrical work of this section which is not otherwise specified.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.3 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing (Basic Mechanical and Division-01 requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.

1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:

B. Temperature Rating: Rated for 113 degrees F (40 degrees C) environment with maximum 122 degrees F (50 degrees C) temperature rise for continuous duty at full-load (Class B Insulation).

C. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than five (5) starts per hour for manually controlled motors.

D. Phases and Current Characteristics: Provide squirrel cage induction polyphase motors for 1/2 hp (.4 kW) and larger, and provide capacitor-start single-phase motors for 1/3 hp (.25 kW) and smaller, except 1/6 hp (.1 kW) and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-22 requirements. For 2-speed motors provide two (2) separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

F. Motor Construction: Provide general purpose, continuous duty motors, Class F insulation, Design "B" except "C" where required for high starting torque.

1. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division-22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.

2. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division-22 for other enclosure requirements.

3. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.

4. Noise Rating: Provide industry standard "Quiet" rating on motors.

5. Efficiency: For motors 1 horsepower (.7 kW) or higher, provide motors with minimum efficiencies as follows in accordance with IEEE Standard 112, Test Method B:

   a. Open Motors (ODP)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	1200 RPM	1800 RPM	3600 RPM
1 (.7)	82.5%	85.5%	77.0%
1.5 (1.1)	86.5%	86.5%	84.0%
2 (1.5)	87.5%	86.5%	85.5%
3 (2.2)	88.5%	89.5%	85.5%
5 (4)	89.5%	89.5%	86.5%
7.5 (5.6)	90.2%	91.0%	88.5%
10 (8)	91.7%	91.7%	89.5%
15 (11)	91.7%	93.0%	90.2%
20 (15)	92.4%	93.0%	91.0%
25 (19)	93.0%	93.6%	91.7%
30 (22)	93.6%	94.1%	91.7%
40 (30)	94.1%	94.1%	92.4%
50 (38)	94.1%	94.5%	93.0%
60 (45)	94.5%	95.0%	93.6%
75 (56)	94.5%	95.0%	93.6%
100 (75)	95.0%	95.4%	93.6%

   * Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

   b. Enclosed Motors (TEFC)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	1200 RPM	1800 RPM	3600 RPM

1 (.7)	82.5%	85.5%	77.0%
1.5 (1.1)	87.5%	86.5%	84.0%
2 (1.5)	88.5%	86.5%	85.5%
3 (2.2)	89.5%	89.5%	86.5%
5 (4)	89.5%	89.5%	88.5%
7.5 (5.6)	91.0%	91.7%	89.5%
10 (8)	91.0%	91.7%	90.2%
15 (11)	91.7%	92.4%	91.0%
20 (15)	91.7%	93.0%	91.0%
25 (19)	93.0%	93.6%	91.7%
30 (22)	93.0%	93.6%	91.7%
40 (30)	94.1%	94.1%	92.4%
50 (38)	94.1%	94.5%	93.0%
60 (45)	94.5%	95.0%	93.6%
75 (56)	94.5%	95.4%	93.6%
100 (75)	95.0%	95.4%	94.1%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

c. Where fan or pump motors are used in conjunction with, or controlled by, a variable frequency drive (VFD), motors shall be suitable for VFD operation (inverter duty motors).

d. For motors less than 1 horsepower (.7 kW), provide motors with higher efficiency than "average standard industry motors," in accordance with IEEE Standard 112, test method B.

G. Nameplate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special feature and similar information.

H. Motor Modifications: In cases where the equipment submitted requires additional motors and/or controls, circuiting and related equipment shall be provided as approved and in accordance with the National Electrical Code. All costs relative to these electrical

changes shall be included under the Section in which the equipment is furnished and installed and shall be coordinated with the electrical work at no expense to the Owner.

I. Power Factor: All motors one (1) horsepower and above shall have a minimum power factor of 0.90.

J. All motors operated on variable frequency drives shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two (2) rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one (1) shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.

2.2 MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFDS)

A. Where motor starters and/or variable frequency drives (VFDs) are indicated for mechanical equipment, they shall comply with all requirements outlined with the electrical specifications for motor starters and VFDs. Where motor starters and/or VFDs are provided by the mechanical contractor, or as a portion of a packaged mechanical unit, the electrical specifications shall also apply. All VFDs for the project, whether provided by the mechanical or electrical contractor, shall be provided by a single manufacturer, and shall include the same features and options.

2.3 MECHANICAL EQUIPMENT

A. All mechanical equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp (.25 kW) and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory installed on equipment unit to electrical Installer for installation.

C. Install furnished under Division-26 starter panels and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate in accordance with National Electric Code for installation requirements.

END OF SECTION 22 05 13

SECTION 22 05 14 - PIPE, TUBE AND FITTINGS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Steel Pipes
2. Copper Tube
3. Cast-Iron Pressure Pipes
4. Cast-Iron Soil Pipes
5. Plastic Pipes
6. Foundation Drainage Tile and Pipes
7. Grooved Piping Products
8. Miscellaneous Piping Materials/Products

C. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division-22 sections.

D. Refer to all Division-21 and -22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B 3 1.1, or ASME B 31.9, as applicable, for shop and project site welding of piping work.

    a. Certify welding of piping work using the Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

2. Brazing: Certify brazing procedures, brazers and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

4. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:

1. ASME Code for Pressure Piping B31, most current edition.

2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of pipe and pipe fitting. In addition, submit a matrix indicating each service and the proposed pipe material and fitting.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Except for hub-and-spigot and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage, and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service; where type, grade or class is not indicated. Provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

A. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

B. Seamless Steel Pipe: ASTM A 53, A 106, or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required.

C. Galvanized Seamless Steel Pipe: ASTM A 53 or A 120; except comply with ASTM A 53 where close coiling or bending is required.

D. Electric-Resistance-Welded Steel Pipe: ASTM A 135.

E. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.

F. Steel Water Pipe: AWWA C200 for pipe 6" (150 mm) and larger.

G. Coal Tar Protective Coatings and Linings for Steel Water Pipe: AWWA C203 for enamel and tape, hot applied.

H. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.

I. Cast-Iron Threaded Fittings: ANSI B16.4.

J. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.

K. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

L. Threaded Pipe Plugs: ANSI B16.14.

M. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.

1. Material Group: Group 1.1.
2. End Connections: Buttwelding.
3. Facings: Raised-face.

N. Steel Pipe Flanges for Waterworks Service: AWWA C207.

O. Corrosion-Resistant Cast Flanges/Fittings: MSS SP-51, including bolting and gasketing.

P. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11 except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

Q. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

R. Cast-Iron Threaded Drainage Fittings: ANSI B16.12.

S. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.

T. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2" (40 mm), and where pipe size is less than 1-1/2" (40 mm), and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS

A. Copper Type: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.

B. DWV Copper Tube: ASTM B 306.

C. ACR Copper Tube: ASTM B 280.

D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.

G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

H. Cast-Copper Flared Tube Fittings: ANSI B16.26.

I. Bronze Pipe Flanges/Fittings: ANSI B16.24.

J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 CAST-IRON PRESSURE PIPES AND PIPE FITTINGS

A. Ductile-Iron Pipe: ANSI A21.51; AWWA C151.

B. Polyethylene Encasement for Gray and Ductile Cast-Iron Piping: ANSI A21.5; AWWA C105.

C. Cast-Iron Fittings: AWWA C110.

D. Gray-Iron Fittings: AWWA C110.

E. Ductile-Iron Fittings: AWWA C110.

F. Rubber-Gasket Joints: AWWA C111.

2.5 CAST-IRON SOIL PIPES AND PIPE FITTINGS

A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.

B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.

C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.

D. Cast-Iron Hub-and-Spigot Soil Pipe: Match soil pipe units; complying with same standards (ASTM A 74).

E. Compression Gaskets: ASTM C 564.

2.6 PLASTIC PIPE AND FITTINGS

A. Virgin Rigid Polyvinyl Chloride (PVC) Schedule 40 Pipe: Solid wall pipe with a cell class of 12454. Materials shall comply with ASTM D 1784, ASTM D 1785, ASTM D 2665 and NSF Standards 14 and 61.

B. Virgin Rigid Polyvinyl Chloride (PVC) Schedule 80 Pipe: Solid wall pipe with a cell class of 12454. Materials shall comply with ASTM D 1784, ASTM D 1785, and NSF Standards 14 and 61.

C. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC) Pipe: Copper Tube Size (CTS), Standard Dimensional Ratio (SDR) 11 with a cell class of 24448. Materials shall comply with ASTM D 1784, ASTM D 2846, and NSF Standards 14 and 61.

D. Fittings for PVC Schedule 40 Pipe:

1. Injection molded PVC DWV fittings: ASTM D 2665.

2. Fabricated PVC DWV fittings: ASTM F 1866.

3. All fittings shall conform to NSF Standard 14.

E. Fittings for PVC Schedule 80 Pipe:

1. Injection molded PVC DWV fittings: ASTM D 2467.

2. Threaded PVC Schedule 80 fittings: ASTM D 2464.

3. All fittings shall conform to NSF Standards 14 and 61.

F. Fittings for CPVC Pipe: ASTM D 2846, NSF Standards 14 and 61.

2.7 FOUNDATION DRAINAGE TILE AND PIPE FITTINGS, AND ACCESSORIES

A. Corrugated High Density Polyethylene Drainage (Perforated) Pipe: Piping shall be single wall and perforated with holes, applicable for storm drainage.

B. Rigid Perforated Polyvinyl Chloride Pipe (PVC): ASTM D 2729; perforated except where standard sections of pipe are indicated.

C. Fittings for Accessories for Foundation Drainage Tile and Pipe: Unless otherwise indicated, match and of same material as pipe units; comply with same standards, where applicable, except fittings need not be perforated where pipe is required to be perforated.

2.8 GROOVED PIPING PRODUCTS

A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used only in mechanical rooms and areas where piping is installed above acoustic tile ceilings for the following systems in lieu of welded, flanged or threaded methods:

1. Fire protection

2. Domestic water

B. Coupling Housings:

1. Coupling Housings: Malleable iron conforming to ASTM A 47.

2. Coupling Housings: Ductile iron conforming to ASTM A 536.

C. Coupling Housings Description: Grooved mechanical type, which engages roll grooved pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature.

D. Gaskets: Mechanical roll grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.

1. Water Services: EDPM Grade E, with green color code identification.

2. Other Services: As recommended by manufacturer.

E. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi (758420 kPa).

1. Exposed Locations: Tamper resistant nuts.

F. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.

G. Fittings: Roll grooved end design to accept grooved mechanical couplings.

1. Malleable Iron: ASTM A 47.

2. Ductile Iron: ASTM A 536.

3. Fabricated Steel: ASTM A 53, Type F for 3/4" (20 mm) to 1-1/2" (40 mm): Type E or S, Grade B for 2" (50 mm) to 20" (500 mm).

4. Steel: ASTM A 234.

H. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.

1. Malleable Iron: ASTM A 47.

2. Ductile Iron: ASTM A 536.

I. Roll Grooves: Conform to the following:

1. Lightweight Steel: Roll grooved.

2.9 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

1. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.

2. Silver Solder: ASTM B 32, Grade 96TS.

C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

D. Gaskets for Flanged Joints: ANSI B16.21; full-faced or cast-iron raised face for steel flanges, unless otherwise indicated.

E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" (1.6 mm) misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Where trapping is unavoidable, install drain valve with 3/4" (20 mm) hose end connection, cap and chain. Provide access panels as required. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" (25 mm) clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Exposed piping in finished areas shall be covered with a 16 gauge steel cover primed and painted, secured to an adjacent structure and painted to match adjacent surfaces.

D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

A. General: Provide joints of type indicated in each piping system.

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting

manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.

3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

B. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.

C. Weld pipe joints in accordance with recognized industry practice and as follows:

1. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible.

2. Bevel pipe ends at a 37.5˚ angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

3. Use pipe clamps or tack-weld joints with 1" (25 mm) long welds; 4 welds for pipe sizes to 10" (250 mm), 8 welds for pipe sizes 12" (300 mm) to 20" (500 mm).

4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

6. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

7. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.

D. Weld pipe joints of steel water pipe in accordance with AWWA C206.

E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

F. Lead Joint Installation: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, caulk joint tightly by use of hammer and calking iron.

G. Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

H. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:

1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.

2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.

I. Open Drain-Tile Joints: Except as otherwise indicated, provide 1/4" (6 mm) open joint with top 2/3 of annular space covered by joint accessory material.

J. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 PIPING INSTALLATION

A. Install drain tile piping from lowest end of slope to highest, solidly bedded in filtering or drainage fill. Shape bed for bells of piping (if any). Place bells/hubs and grooved ends of units up-stream. Lay perforated pipe with perforations down. Refer to Division-2 specifications for filter cloth, bedding material and backfill installation requirements.

B. Install ductile cast-iron water mains and appurtenances in accordance with-AWWA C600.

3.4 RADIOGRAPHIC (X-RAY) TESTING

A. Field weld joints for all black steel pipe shall be radiographically (x-ray) tested to the extent identified below.

B. Testing shall be conducted by an independent testing company. The testing company shall provide arrest report identifying the results of each weld tested (pass/fail).

C. The Contractor shall engage the Owner and Engineer of Record to identify welds to be tested.

D. Testing:

1. If the total quantity of field welds is greater than 50, test 10% of field welds.

2. If the total quantity of field welds is less than 50, test 25% of field welds.

3. Should any of the initial welds tested fail, Contractor will be required to test an additional 20% of all remaining welds, at no additional cost to the Owner.

4. Should any of the additional 20% of welds tested fail, Contractor will be requested to test 100% of all remaining welds, at no additional cost to the Owner.

3.5 PIPE TESTING

A. The mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a. Air, Gas

2. Hydrostatic Test:

a. Domestic Water

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Hydrostatic Test: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is four (4) hours.

2. Hydrostatically test each piping system at 150% of operating pressure indicated, but not less than 100 psi (690 kPa) test pressure.

3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than zero percent (0.0%) of test pressure.

4. Upon completion of roughing-in and before setting fixtures, the entire new domestic water system shall be tested. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.

5. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

D. Air Test:

1. Air, gas and vacuum piping shall be air tested at 200 psi (1380 kPa).

2. Prior to testing, verify the pressures listed above are in accordance with the latest ASME B31 code and NFPA. Should a discrepancy exist between the ASME B31 code, NFPA, and/or the pressures indicated above, contact the Engineer prior to testing.

3. Required test period is four (4) hours.

4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds less than zero percent (0.0%) of test pressure.

E. Sanitary and Storm Water Piping Systems:

1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.

2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof or to the maximum pressure rating of the joint used. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

3. Where sections are tested, overlap the sections so that all joints are subjected to the test procedures.

F. Drain test water from piping systems after testing and repair work has been completed.

G. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

H. Contractor shall submit pipe leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Pipe test results shall be recorded on the attached “Piping Leakage Test Summary Form - Plumbing” at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the pipe test section (each pipe test section shall be numbered and color coded).

I. All pipe leakage test results shall be included with the final TAB report and the O&M Manual.

3.6 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

C. After final testing for leaks, all new potable water lines shall be thoroughly flushed by plumbing contractor to remove foreign material. Before placing the systems in service, Contractor shall engage a qualified service organization, to sterilize the systems in accordance with the following procedure:

1. Through a 3/4" (20 mm) hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 PPM. Plumbing contractor shall provide plumbing connections and power for pumping chlorine into the system.

2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.

3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 PPM chlorine, retain this water in the system for three hours. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system.

4. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.

5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 PPM.

6. Obtain representative water samples from the system for analysis by a recognized bacteriological laboratory.

7. If the sample tested for coliform organisms is negative, a letter and laboratory reports shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization.

8. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

END OF SECTION 22 05 14

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PIPING LEAKAGE TEST SUMMARY FORM
(PLUMBING)

Project Name: _____ Project Number: _____ Page ____ of ____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____
Date of Test(s): _____
Test Conducted By (Print/Sign): _____

(1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
(2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas, 10 ft. static head pressure or to the maximum rating of the joint. Include joint cut sheets showing their ratings.
(3) Four (4) hours minimum.
(4) Shall not exceed 0.0%.

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SECTION 22 05 15 - PIPING SPECIALTIES FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:

1. Pipe Escutcheons
2. Pipeline Strainers
3. Vandal-Proof Vent Caps
4. Dielectric Fittings
5. Mechanical Sleeve Seals
6. Penetration Seals
7. Water Hammer Arresters
8. Drip Pans
9. Pipe Sleeves
10. Sleeve Seals
11. Flexible Connector
12. Domestic Water Mixing Valve
13. Electric Pipe Trace

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

2. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating fabrication, materials, and method of support.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections.

2.2 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi (850 kPa) working pressure, with Type 304 stainless steel screens, with perforations as follows:

1. Piping 2" (50 mm) and Smaller: 1/32" (.8 mm) diameter perforations.

2. Piping 2-1/2" (65 mm) and Larger: 3/64" (1.2 mm) diameter perforations for water systems and 1/16" diameter perforations for steam systems.

B. Threaded Ends, 2" (50 mm) and Smaller: Brass, screwed screen retainer with centered blowdown fitted with valve and pipe plug.

C. Threaded Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

D. Flanged Ends, 2-1/2" (65 mm) and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

E. Butt Welded Ends, 2-1/2" (65 mm) and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with valve and pipe plug.

F. Grooved Ends, 2-1/2" (65 mm) and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

2.4 VANDAL-PROOF VENT CAPS

A. General: Provide cast-iron vandal-proof vent caps, full size of vent pipe, caulked base connection for cast-iron pipes, threaded base for steel pipes.

2.5 DIELECTRIC FITTINGS

A. General: Provide assembly or fitting having insulating material to isolate dissimilar metals to prevent galvanic action and stop corrosion.

1. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035 kPa or 2070 kPa) minimum working pressure to suit system pressures.

2. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070 kPa) working pressure at 225°F (107°C) temperature.

3. Dielectric unions shall NOT be acceptable.

2.6 MECHANICAL SLEEVE SEALS

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 PENETRATION SEALS

A. Provide seals for all openings through fire-rated walls, floors, or ceilings used as passage for mechanical piping. See Division-22 Section “Basic Plumbing Materials and Methods” for penetration seals and firestopping requirements.

B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as piping.

2.8 WATER HAMMER ARRESTERS

A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi (1724 kPa), tested and certified in accordance with PDI Standard WH-201.

2.9 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" (65 mm). Reinforce top, either by structural angles or by rolling top over 1/4" (6 mm) steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" (25 mm) drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" (75 mm) and smaller, 20 gage (1.0 mm); 4" to 6" (100 mm to 150 mm), 16 gage (1.6 mm); over 6" (150 mm), 14 gage (2 mm).

2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.10 FLEXIBLE CONNECTORS

A. Furnish and install braided stainless steel flexible connectors on the inlet and outlet of each pump, chiller, cooling tower, and all other piping connected to a vibrating piece of equipment. Construction shall be of annular corrugated stainless steel close-pitch hose with stainless steel overbraid.

1. The corrugated metal hose, braids, and a stainless steel ring-ferrule/band (material gauge not less than .048") (material gauge not less than 1.2 mm) shall be integrally welded using a 100% circumferential, full-penetration TIG weld.

2. End fittings shall be flat-face plate steel flanges with 150#ANSI drilling and outside diameter. Fittings shall be attached using a 100% circumferential TIG/MIG weld.

3. Braided stainless steel connectors shall be suitable for operating temperatures up to 850°F (454°C).

4. The rated working pressure of braided metal hose shall have a minimum 4:1 safety factor based on an operating temperature of 70°F (20°C). Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

5. Flanged connectors shall be prepared for shipment using cut-to-length spacers, securely positioned between the flanges to prevent axial compression damage and maintain the manufactured length. Spacers must be removed prior to system start-up.

6. All braided stainless steel connectors shall be covered by a three (3) year warranty.

7. Minimum overall lengths shall be as follows:

Through 4" (100 mm) diameter:	9" (225 mm)
5" (125 mm), 6" 150 mm) diameter:	11" (275 mm)
Over 6" (150 mm) diameter:	1.5 times nominal diameter

2.11 DOMESTIC HOT WATER MIXING VALVES

A. Thermostatic Mixing Valve:

1. Furnish and install where indicated on the floor plans. Refer to floor plans/details for manufacturer, size, model and setting. Mixing valve for tempered water controls shall be of the thermostatic type with liquid sensor and shall be in accordance with ASSE 1017. Valve shall be constructed of a bronze body with internal non-corrosive parts. Valve construction shall employ poppets which are independently seated, balanced, and self-aligning. Union inlets with strainers and check stops shall be provided. Temperature adjustment control shall be tamper-resistant. Provide thermometer on outlet and valved inlets.

2.12 ELECTRIC PIPE TRACING

A. Furnish and install self-regulating pipe trace heater consisting of two (2) 16 AWG nickel plated copper bus parallel wires embedded in a self-regulating polymer core that varies its power output to respond to temperature along its length, allowing the heater to cross over itself without overheating, and to be cut to length in the field. The heater shall be covered by a radiation cross linked polyethylene dielectric jacket rated at 300 VAC at 222°F (105°C) with VW-1 flame resistance.

B. The heater shall operate on line voltage 120V, without the use of transformers.

C. The heater shall be sized according to the following table. The output rating is in watts per linear foot at 50˚F (10˚C).

Pipe Size	Heater Capacity
1/2 - 1 inch (13 mm - 25 mm)	3 W/LF (1 W/m)
1-1/4 - 2 inch (32 mm - 50 mm)	5 W/LF (1.6 W/m)
3 inch (75 mm)	5 W/LF (1.6 W/m)
4 inch (100 mm)	8 W/LF (2 W/m)
6 inch (150 mm)	8 W/LF (2 W/m)

D. All heating cable cores shall be permanently marked with manufacturer's batch or serial number for traceability. All cable jackets shall be continuously marked with manufacturer's name, catalog number, nominal supply voltage and nominal power output in watts per foot. Use of temporary printing or tags not permitted.

E. All cables shall be capable of withstanding 1,600 VAC RMS (50 to 60 HZ) applied for one minute between the parallel conductors and the metallic braid.

F. Power retention of the heating element shall be a minimum of 90% after a minimum of 30 thermal cycles between 50°F and 150°F (10°C and 66°C).

G. Power connection, end seal, splice and tee kit components shall be applied in the field.

H. The system shall be controlled by an ambient sensing thermostat set at 40°F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" (50 mm) and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to drain, full size of blow down connection.

1. Locate Y-type strainers ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:

a. Pumps

b. Pressure reducing valves

c. Temperature or pressure regulating valves

C. Vandal-Proof Vent Caps: Install vandal-proof vent caps on each vent pipe passing through roof, and elsewhere as indicated. Locate base of vent cap 6" (150 mm) above roof surface, or higher where required by Code.

D. Dielectric Fittings: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

E. Mechanical Sleeve Seals: Provide mechanical sleeve seals for sleeves located in foundation walls below grade, or in exterior walls. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

F. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' (0.9 m) horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" (25 mm) drain line to drain connection, and run to nearest drain as indicated.

B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by the Owner. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Sleeves through floors shall be flush with the floor, except for sleeves passing through equipment rooms, toilet rooms (and other wet areas) which shall extend 3/4" (20 mm) above the floor. Space between the pipe and sleeve shall be caulked. Escutcheons plates shall be constructed to conceal the ends of sleeves. Extend floor sleeves 1/4" (6 mm) above level floor finish and 3/4" (20 mm) above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.

2. Install iron-pipe sleeves at exterior and interior foundation wall penetrations, both above and below grade. Penetrations shall be sealed weathertight.

3. Install steel-pipe except as otherwise indicated.

3.3 INSTALLATION OF ELECTRIC PIPE TRACING

A. Provide electric heat trace for all exterior piping, located above the local frost line, and including, but not limited to, fire protection piping, domestic water, and wet traps of sanitary located in the Garage of each building, etc.

B. Install the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or type PF-1 polyester tape.

C. Apply "electric traced" signs to the outside of the thermal insulation.

D. Tests:

1. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum installation resistance should be 20 to 1000 megohms regardless of length.

E. Insulate all piping where heat trace is required. Refer to Division-22 section, Plumbing Insulation for type and thickness.

3.4 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

A. Provide flexible pipe connectors on the inlet and outlet of piping connected to a vibrating piece of equipment. Flexible connectors shall be full line size as indicated on the drawings and should be provided with control rods.

END OF SECTION 22 05 15

SECTION 22 05 16 - EXPANSION COMPENSATION FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of expansion compensation products required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of expansion compensation products specified in this section include the following:

1. Packless Expansion Joints:

C. Expansion Compensators

D. Expansion compensation products furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. EJMA Compliance: Construct compensation products in accordance with standards of the Expansion Joint Manufacturer's Association (EJMA).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of expansion compensation product. Submit expansion compensation schedule showing manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of expansion compensation product, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes, and location and method of attachment of anchors.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data, product data, and shop drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Flexonics Inc., Metal Hose and Expansion Joint Div.
2. Keflex HVAC Products, Flex-Weld, Inc.
3. Metraflex Co.
4. Mason Industries, Inc.
5. Vibration Mountings and Controls, Subsidiary of ARX.

2.2 PACKLESS EXPANSION JOINTS

A. General: Provide packless expansion joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Select packless expansion joints to provide 200% absorption capacity of piping expansion between anchors.

B. Expansion Compensators: Pressure rated for 60 (415 kPa) psi for low pressure systems, 175 psi (1200 kPa) for high pressure systems; 2-ply phosphor bronze bellows, brass shrouds and end fittings for copper piping systems, or 2-ply stainless steel bellows, carbon steel shrouds and end fittings for steel piping systems. Provide internal guides and anti-torque device, and removable end clip for proper positioning.

2.3 MISCELLANEOUS MATERIALS

A. Pipe Alignment Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which expansion compensation products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 EXPANSION JOINTS

A. General: Install expansion joints where indicated, and elsewhere as required for adequate expansion of installed piping system. Install in accordance with manufacturer's instructions. Provide pipe anchors and pipe alignment guides as indicated, and in accordance with manufacturer's recommendations. Align units properly to avoid end loading and torsional stress.

3.3 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as required for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as required to properly anchor piping in relationship to expansion loops.

3.4 EXPANSION COMPENSATION FOR RISERS AND TERMINALS

A. General: Install connection between piping mains and risers with at least five (5) pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four (4) pipe fittings including tee in riser.

3.5 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principle pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 22 05 16

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SECTION 22 05 19 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other division-22 sections.

B. Types of meters and gauges specified in this section include the following:

1. Temperature Gauges and Fittings:

a. Direct Mount Dial Thermometers

b. Remote Reading Dial Thermometers

c. Thermometer Wells

2. Pressure Gauges and Fittings:

a. Pressure Gauges

b. Pressure Gauge Cocks

c. Pressure Gauge Connector Plugs

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

2. ANSI and ISA Compliances: Comply with applicable portions of American National Standards Institute (ANSI) and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

3. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

B. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.1 DIRECT MOUNT DIAL THERMOMETERS

A. General: Provide direct mount dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension, universal angle.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter gauge.

D. Adjustable Joint: Die cast aluminum, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.

E. Thermal Bulb: Copper with phosphor bronze bourdon pressure tube, one scale division accuracy.

F. Movement: Brass precision geared.

G. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.

H. Stem: Copper plated steel, or brass, for separable socket, length to suit installation.

I. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).

2.2 REMOTE READING DIAL THERMOMETERS

A. General: Provide remote reading dial thermometers of materials designed and constructed for use in service indicated.

B. Type: Vapor tension.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) diameter shall be used.

D. Movement: Brass, precision geared.

E. Tubing: Bronze double braided armor over copper capillary, length to suit installation.

F. Bulb: Copper with separable socket for liquids, averaging element for air.

G. Accuracy: + one scale division.

H. Range: Conform to the following:

1. Hot Water: 30°F - 240°F (-1°C - 116°C).

2.3 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" (50 mm) extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

B. Manufacturer: Same as thermometers.

2.4 PRESSURE GAUGES

A. General: Provide pressure gauges of materials designed and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B 40.1 Grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, glass lens, 5" (125 mm) diameter. For gauges mounted above eight feet (2400 mm), 8" (200 mm) gauges shall be used.

D. Connector: Brass with 1/4" (6 mm) male NPT. Provide protective syphon when used for steam service.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:

1. Water: 0 - 100 psi (0 - 690 kPa).

2.5 PRESSURE GAUGE COCKS

A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" (6 mm) female NPT on each end, and "T" handle brass plug.

B. Syphon: 1/4" (6 mm) straight coil constructed of brass tubing with 1/4" (6 mm) male NPT on each end.

C. Snubber: 1/4" (6 mm) brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

D. Manufacturer: Same as for pressure gauges.

2.6 PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide pressure gauge connector plugs pressure rated for 500 psi (3448 kPa) and 200°F (93°C). Construct of brass and finish in nickel plate, equip with 1/2" (13 mm) NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" (3 mm) O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install direct mounted thermometers in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.

2. At discharge of each domestic water heater.

C. Remote Reading Dial Thermometers: Install on control panels as indicated. Run tubing between panel and thermometer bulb, adequately supported to prevent kinks. Select tubing length so as to not require coiling of tubing.

D. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

3.3 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.
2. At inlet and outlet of each pressure reducing valve.
3. At incoming services (domestic water, fire and gas).
4. At inlet and outlet of large strainers.
5. At inlet of expansion tanks.
6. At inlet and outlet of domestic water booster pump package.
7. At the top of each standpipe riser.
8. At inlet and outlet of backflow preventers.

C. Pressure Gauge Cocks: Install in piping tee with snubber.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows and repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 19

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SECTION 22 05 23 - VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of valves specified in this section include the following:

1. Gate Valves
2. Globe Valves
3. Drain Valves
4. Ball Valves
5. Butterfly Valves
6. Check Valves

C. System Descriptions:

1. Domestic Water Piping: Domestic water piping shall relate to potable and non-potable cold water, hot water piping systems.

D. Valves furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Valve Types: Provide valves of same type by same manufacturer.

B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating and size clearly marked on valve body.

C. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.

4. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61- G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following, unless otherwise noted:

1. Milwaukee

2. Bray

3. Apollo

4. DeZurik

5. Jamesbury

6. Watts

B. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

C. Size: Unless otherwise indicated, provide valves of same size as upstream pipe size. Pipe size reduction shall be made after valve assembly.

D. Valve Features: Provide the following as required:

1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.

2. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.

3. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.

4. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).

5. Threaded: Valve ends complying with ANSI B2.1.

6. Butt-Welding: Valve ends complying with ANSI B16.25.

7. Socket-Welding: Valve ends complying with ANSI B16.11.

8. Solder-Joint: Valve ends complying with ANSI B16.18.

9. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2.2 GATE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-70.

2. Bronze Valves: MSS SP-80.

3. Steel Valves: ANSI B16.34.

B. Fire Department Valves (Standpipes):

1. Hose End; 2-1/2" (65 mm): FM, 175 psi (1200 kPa), bronze body, solid wedge, inside screw, non-rising stem, with cap and chain.

C. Fire Protection and Incoming Water Services:

1. Threaded End; 2" (50 mm) and Smaller: FM, UL-listed, 175 psi (1200 kPa), bronze body, solid wedge, outside screw and yoke, rising stem. Milwaukee Model 118 or equivalent.

2. Flanged End; 2-1/2" (65 mm) and Larger: FM, UL-listed, 175 psi (1200 kPa), iron body bronze mounted, solid wedge, outside screw and yoke, rising stem. Milwaukee Model F2885FP or equivalent.

2.3 GLOBE VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-85.

2. Bronze Valves: MSS SP-80.

3. Steel Valves: ANSI B16.34.

B. Domestic Water Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, union bonnet, integral seat, renewable TFE disc. Milwaukee Model 590T (Threaded), 1590T (Sweat) or equivalent.

2. Flanged Ends; 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, renewable seat and disc, bronze mounted. Milwaukee Model F2981A or equivalent.

2.4 DRAIN VALVES

A. Comply with the following standards:

1. Water Heater Drain Valves: ASSE 1005.

B. Domestic Water Piping:

1. 3” (75 mm) and Smaller: Class 125, bronze body ball valve with chrome plated ball, hose end with cap and chain. Milwaukee BA100H (Threaded), Milwaukee BA150H (Sweat) or equivalent.

2.5 BALL VALVES

A. Comply with the following standards:

1. Bronze Valves: MSS SP-110.

2. Potable Water: NSF-61-8.

B. Domestic Water Piping:

1. 2” (50 mm) and Smaller: Valves shall be rated 150 psi (1035 kPa) SWP and 600 psi (4140 kPa) non-shock WOG and shall have 2-piece cast ASTM B 584 bronze bodies, TFE seats, standard port, separate packing nut with adjustable stem

packing, anti-blowout stems and stainless steel ball. Valve ends shall have full depth ANSI threads or extended solder connections and be manufactured to comply with MSS-SP110. Milwaukee BA100S (Threaded), BA150S (Sweat) or equivalent. For potable water applications provide NSF/ANSI 1372 (NSF-61-G) compliant “lead free” valves; Milwaukee UPBA 100/150 or equivalent.

C. Natural Gas Service:

1. 2” (50 mm) and Smaller: 600 lb WOG, 150 lb SWP, 2 piece body style, full port, chrome plated ball, bronze body of ASTM B283 forged brass body, hex gland follower, blow out proof stem, lever handle. Valves shall be CSA, UL and FM approved. Milwaukee BA 475 (Threaded) or equivalent.

2. 2-1/2” (65 mm) and larger: Consult valve manufacturer for suggested valve over 2” for gas service (Milwaukee does not offer a gas agency approved valve over 2”)

D. Where piping is insulated, ball valves shall be equipped with 2" (50 mm) extended handles of non-thermal conductive material. Also, provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which are fully adjustable after insulation is applied, shall be included.

2.6 BUTTERFLY VALVES

A. General: Comply with MSS SP-67. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select bubble tight, lug body type valves suitable for dead end service.

B. Domestic Water Piping:

1. 2-1/2” (65 mm) to 6" (150 mm): 200 psi (1380 kPa), ductile iron, ASTM A 536 lug body. EPDM seat, 316 SS disc and stem, lever operated. Milwaukee model ML224E or equivalent. For food and beverage applications, provide Milwaukee model ML224NW or equivalent. For potable water applications provide NSF/ANSI 372 (NSF 61- G) compliant “lead free” valves; Milwaukee ML 233E (lever operated), Milwaukee ML 333E (gear operated) or equivalent.

2. All valves shall be capable of bubble tight dead end service in either direction without use of additional pinning, screws or mating flanges.

2.7 CHECK VALVES

A. Comply with the following standards:

1. Cast-Iron Valves: MSS SP-71.

2. Bronze Valves: MSS SP-80.

3. Steel Valves: ANSI B16.34.

B. Domestic Water Piping:

1. 2" (50 mm) and Smaller: Class 150, bronze body, horizontal swing, T pattern with renewable TFE disc. Milwaukee 510T (Threaded), 1510T (Sweat) or equivalent.

2. 2-1/2" (65 mm) and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Milwaukee F2974A or equivalent.

C. Fire Protection:

1. 2-1/2" (65 mm) and Larger; FM: 175 psi (1200 kPa), iron body bronze mounted, renewable composition disc and bronze seat ring, bolted cover, flanged ends. Milwaukee F2974FP or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements.

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines, service mains and all equipment connections. Locate valves so as to be accessible and so that separate support can be provided when necessary.

2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with connections to match pipe fittings.

D. Renewable Seats: Install valves with renewable seats, where applicable.

E. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principle reason for valve, install ball, globe or butterfly valves, as indicated.

F. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.2 ADJUSTING AND CLEANING

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Valve Identification: Tag each valve in accordance with Division-22 section "Identification for Plumbing Piping and Equipment".

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of hangers and supports specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Building Attachments
5. Saddles and Shields
6. Spring Hangers and Supports
7. Miscellaneous Materials
8. Roof Equipment Supports
9. Anchors
10. Equipment Supports

C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hangers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.

3. MSS Standard Compliance:

   a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

   b. Select and apply pipe hangers and supports, complying with MSS SP-69.

   c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.

   d. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or

corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which hangers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

A. Install attachments at required locations within concrete steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields.

3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

4. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated saddles as follows:

a. For domestic hot and cold water piping, provide the following:

b. Minimum 3.75 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.

c. For cold applications below 75ºF (24ºC) a zero permeability, abuse resistant, vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.

d. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.

e. Provide visible inspection sticker at the bottom of each saddle.

f. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

3.4 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.5 EQUIPMENT SUPPORTS

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-22. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.6 PAINTING

A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 22 05 29

SECTION 22 05 48 - VIBRATION ISOLATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all Division-22 specifications, and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.

B. Types: Types of vibration isolation equipment and systems specified in this Section include:

TYPE	DESCRIPTION
1 Isolator	Ribbed Neoprene Pads
2I Isolator	Neoprene-In-Shear Type
2H Hanger	Rubber-In-Shear Type
3I Isolator	Open Spring Type
3H Hanger	Combination Spring and Neoprene Type
4 Isolator	Vertically Restrained Spring Isolators
5 Thrust	Restraints Spring Type Installed in Pairs
A Base	Directly Bolted Attachment
B Base	Structural Rails or Bases
C Base	Concrete Inertia Type

C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.

1. Conform to isolator types herein specified.

2. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.

3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, Sound and Vibration Control.

1.2 QUALITY ASSURANCE

A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook.

B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.

B. Manufacturer's Certification: The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.

C. Product Data: Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.

1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.

a. Shop Drawings: Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.

b. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

A. Storage: Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.

1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Mason

2. Vibration Eliminator Co.

3. Kinetics Noise Control

2.2 EQUIPMENT

A. Dimensions: The schedule shows dimensions for deflection and sizes all in inches.

B. Spans: Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.

C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.

1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.

2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

A. Type 1 Isolators: Provide pad type vibration isolators consisting of either two layers of 3/8-inch (10 mm) thick elastomer, molded to contain a pattern with non-slip characteristics in all directions, and bonded to 16 gauge (1.6 mm) galvanized steel separator plates, or 1-inch (25 mm) thick precompressed molded fiberglass isolation pads. Minimum overall thickness shall be 1-inch (25 mm). Deflection shall be limited to

0.25 inches (6 mm) or less. Loading shall not exceed 40 pounds per square inch (280 kPa).

B. Type 2I Isolators: Provide double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in the top and bottom portions.

1. Deflections shall be limited to 0.5 inches (13 mm) or less.

2. Steel bases shall be drilled with mounting holes and equipment mounting points shall be threaded male or female connections.

3. Treat resilient material with antiozone and antioxidant additives.

C. Type 2H Hangers: Provide rubber-in-compression suspension hangers, consisting of a formed steel frame and elastomer isolation element and provided with attachments for top and bottom suspension rods.

1. Design for a minimum 200 percent overload without noticeable deformation or failure.

2. Metal components shall be galvanized or factory painted.

D. Type 3I Isolators: Provide adjustable, freestanding, open spring isolators with combination leveling and equipment fastening bases.

1. Spring elements shall be contained in upper and lower housing assemblies and shall have a minimum Kx-Ky of 0.75.

2. Design springs for a minimum travel of 50 percent beyond the rated load.

3. When fully compressed and "bottomed-out", isolators shall be capable of supporting a 150 percent overload without deformation and spring failure.

4. A minimum 1/4-inch (6 mm) thick non-skid isolation pad shall be bonded to the underside of the base plate.

5. Size base plates to limit floor loading to 100 pounds per square inch (690 kPa).

6. Drill base plates for bolting, as required.

7. Provide means for anchoring the top element of the isolator to rails and equipment.

E. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.

1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.

2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.

3. Design hangers for connection to equipment and supporting rods.

F. Type 4 Isolators: Provide vertically restrained, freestanding, laterally stable, open spring type isolators.

1. Design for deflection exceeding 1/2-inch (13 mm).

2. Provide built-in bearing and leveling provisions.

3. Provide a minimum 1/4-inch (6 mm) thick non-slip elastomer vibration absorbing pad bonded to the underside of the isolator base.

4. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.

5. Provide vertical limit stops to prevent hyperextension due to wind loads or upward movement when the load is removed. Limit stops shall not bind or inhibit spring movement during normal operating ranges.

6. For exterior applications, steel housings shall be hot dipped galvanized and springs shall be neoprene or powder coated.

G. Type 5 Thrust Restraints: Provide spring isolators of an adjustable, freestanding type enclosed within tubular mountings and arranged to be installed in pairs across the discharge of fan flexible connectors.

1. Design restraints to resist the thrust caused by duct internal air pressure.

2. Install restraints on duct systems with an internal static pressure exceeding 3 inches water gauge (750 Pa).

3. Restraints shall have the same deflection as isolators installed under the fans.

2.4 BASE TYPES

A. Type A Bases: No supplementary base is required. Vibration isolators, specified elsewhere, shall be attached directly to the supported equipment or structural system.

B. Type B, Structural Rails or Bases: Provide bases designed and supplied by the isolation equipment manufacturer.

1. Construct bases of mill rolled structural sections of sufficient dimension to limit the midpoint deflection or unsupported spans to 1/1440th of the span between isolators.

2. Include equipment static loadings, power transmission, component misalignment and cantilever loadings when designing structural sections.

3. When head room is limited, coordinate the design of structural rails and isolators to reduce mounting heights.

4. Factory finish with two (2) coats of equipment enamel.

C. Type C, Concrete Inertia Bases: Provide concrete inertia bases designed by the isolator manufacturer and arranged to be filled with concrete in the field.

1. Construct base of mill rolled structural steel sections, factory mitered and welded into a rigid frame and supporting No. 4 reinforcing bars welded to the structural frame 8 inches (200 mm) on centers both ways and located 2 inches (50 mm) from the bottom of the block.

2. Arrange for outrigger isolation mountings, anchor bolts and equipment support.

3. Field fill with 3,000 psi cured-strength concrete. Trowel to a smooth hard finish.

4. Clean structural steel of excess concrete and field paint all steel elements with two coats equipment enamel.

5. Configuration of inertia bases shall be rectangular to accommodate equipment supported unless otherwise indicated.

6. Minimum thickness of inertia bases, in addition to providing suitable mass, shall be sufficient to provide stiffness to maintain equipment manufacturer's recommended alignment and duty efficiency of power transmission.

7. Minimum thickness shall be sufficient to result in a base deflection at midpoint of unsupported span of not more than 1/1440th of the span between isolators.

8. Minimum thickness shall be 8 percent of the longest base dimension unless otherwise specified or indicated.

9. For centrifugal pumps, the bases shall be a minimum 6 inches (150 mm) thick.

10. Where inertia bases are used to mount pumps, the bases shall be long enough to support piping elbows for all connections.

2.5 PIPING

A. General: All piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source shall be isolated from the building structure with flexible vibration isolators.

1. Suspend piping on Type 3H hangers.

2. Floor-mounted piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.

B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.

C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.

1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.

2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.

2.6 VIBRATION ISOLATION SYSTEM SELECTION

A. General: The following selections of vibration isolation equipment systems shall be considered as a minimum. For the equipment below, the following code applies:

Letter (i.e. A, B, C) = Base type

Number (i.e. 1, 2, 3, 4) = Isolator type

Decimal number (i.e. 0.25, 1.5, etc.) = Minimum deflection

B. Air Compressors

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Tank Mounted	A 3 0.75	A 3 0.75	A 3 1.5	A 3 2.5
Base Mounted to 500 rpm (52 Rad/s)	C 3 0.75	C 3 0.75	C 3 0.75	C 3 1.5
Over 500 rpm (Over 52 Rad/s)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5

C. Centrifugal Pumps

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Close-coupled thru 7-1/2 hp (5.6 kW)	B or C 2 0.25	C 3 0.75	C 3 0.75	C 3 0.75
Close-coupled 10 hp & above (7.4 kW & above)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5
Bedplate-mounted thru 40 hp (30 kW)	C 3 0.75	C 3 0.75	C 3 1.5	C 3 1.5
50 to 125 hp	C 3 0.75	C 3 0.75	C 3 1.5	C 3 2.5

(37 to 95 kW)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.

B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:

1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.

2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.

1. Unless otherwise specified, all equipment shall be securely bolted to isolators, steel bases or concrete inertia bases.

2. Indoor vibration isolators need not be attached to the structure unless required by local codes.

3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.

B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 22 05 48

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division-22 sections.

B. Types of identification devices specified in this section include the following:

1. Pipe Markers
2. Painted Identification Materials
3. Underground-Type Plastic Line Marker
4. Valve Tags
5. Valve Schedule Frames
6. Engraved Plastic-Laminate Signs
7. Plastic Equipment Markers
8. Plasticized Tags

C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-22 sections.

D. Refer to other Division-22 sections for identification requirements at central-station mechanical control center; not work of this section.

E. Refer to Division-26 sections for identification requirements of electrical work; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" (213 mm X 275 mm) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

C. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:

1. Brady

2. Seton

3. Bunting

2.2 PLUMBING IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-22 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE MARKERS

A. Snap-on Type: Provide pre-printed, semi-rigid, snap-on color coded identification sleeves complying with ANSI A13.1. This type shall be used for insulated pipe sizes 2” and smaller.

B. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive, vinyl markers conforming to ANSI A13.1. This style marker shall be applied to all uninsulated piping; insulated piping 2-1/2” and larger.

C. Flow Direction: Provide flow directional arrows either as part of markers, or separately attached to pipes.

2.4 PAINTED IDENTIFICATION MATERIALS

A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.

2.5 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" (150 mm) wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

1. Provide multi-ply tape consisting of solid aluminum foil core between two layers of plastic tape.

2.6 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage (1.2 mm) polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" (6 mm) high letters and sequenced valve numbers 1/2" (13 mm) high, and with 5/32" (4 mm) hole for fastener.

1. Provide 1-1/2" (40 mm) diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.7 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with lexan.

1. Locate one schedule where directed. Provide second schedule to Owner framed in rigid plastic frame with rigid plastic glazing.

2.8 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm2) or 8" (200 mm) length; 1/8" for larger units.

B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.9 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and schedule number

2. Equipment service

2.10 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed, locations, and concealed gas piping.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 25 feet (7500 mm) along each piping run.

    a. Space fire main, standpipe, and fire sprinkler main markers at intervals not exceeding 10' (3 m) on straight pipe runs unless pipe is painted red throughout.

C. Gas Pipe: Paint exposed gas pipe throughout (except chromium plated).

3.3 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" (150 to 200 mm) below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16" (400 mm), install single line marker.

3.4 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Schedule" of this section.

2. Fire protection valves (shutoff, test, drain, etc. shall be labeled with a rigid plastic identification sign, secured with corrosion-resistant wire or chain, per NFPA 13.

3.5 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2. Fuel-burning units.

3. Pumps, compressors and similar motor driven units.

4. Fire protection valves, as hereinbefore specified.

5. Tanks and pressure vessels.

B. Lettering Size: Minimum 1/4" (6 mm) lettering for name of unit where viewing distance is less than 2'- 0" (600 mm-0 mm), 1/2" (13 mm) high for distances up to 6'- 0" (1800 mm-0 mm), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.6 ADJUSTING AND CLEANING

A. Adjusting: Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each plumbing identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

3.8 IDENTIFICATION SCHEDULE

SERVICE	DESIGNATION
Cold Water	CW
Hot Water	HW
Fire Protection	FIRE
Sprinkler	SPKR
Gas	GAS
Compressed Air	AIR

Sanitary Sewer	SAN
Vent	VENT
Storm Water	SW
Air Conditioning Drain	A/C COND
Pumped Discharge	PD

END OF SECTION 22 05 53

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SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

a. Fiberglass

b. Flexible Elastomeric

2. Equipment Insulation:

a. Fiberglass

b. Flexible Elastomeric

C. Refer to all other Division-22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project. Provide installer’s certification by the manufacturer’s training program where applicable.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Owens Corning
2. Johns Manville
3. Certainteed
4. Armacell
5. Knauf
6. Aeroflex

2.2 PIPE INSULATION MATERIALS

A. Fiberglass Pipe Insulation: ASTM C 547-00, Type 1 (up to 850°F) (up to 454°C), maximum k-value of 0.23 BTU-in/hr-ft2-deg F at a mean temperature of 75°F.

B. Flexible Elastomeric Pipe Insulation: ASTM C 534, Type I (-40°F to 200°F) (-40°C to 93°C), maximum k-value of 0.25 BTU-in/hr-ft²-deg F at a mean temperature of 75°F.

C. Jackets for Piping Insulation: Jacket assembly shall be ASTM C 1136, Type I with vapor retarder (0.02 perms).

1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
2. Encase exterior piping insulation with 26 gauge embossed aluminum jacket with weather-proof construction.

D. Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealer, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C).

B. Flexible Elastomeric Cellular Sheet Insulation: ASTM C 534, Type 2, R-value of 8.0 at 2”, (-40°F to 200°F) (-40°C to 93°C).

C. Jacketing Material for Equipment Insulation: Provide 8 ounce (227 g) canvas or pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard (263 g/m2), or metal jacket at Installer's option, except as otherwise indicated

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide bands, wire, wire netting, tape corner angles, anchors, stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Only install mechanical insulation on systems while not in operation.

3.2 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), fire protection piping except for wet pipe fire mains in Garage, pre-insulated equipment and air conditioning condensate drain piping in mechanical rooms, Garage and/or on roof.

B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:

a. Potable cold water piping

b. Interior above-ground horizontal sanitary piping within 6 ft of roof.

c. Plumbing vents within 6 linear feet (1800 mm) of roof outlet.

d. Above-ground sanitary fixture traps in Garage.

e. Air conditioning condensate drain piping within building.

f. Wet Pipe Fire protection piping in Garage only.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1" (25 mm) thickness.

b. Flexible Elastomeric: 1/2" (13 mm) thickness.

C. Hot Piping:

1. Application Requirements: Insulate the following hot plumbing piping systems:

a. Potable hot water piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

a. Fiberglass: 1" (25 mm) thick for pipe sizes up to 1” (25 mm). 1-1/2” (40 mm) thick for 1-1/4” (32 mm) and 1-1/2” (40 mm) pipe, and 2” (50 mm) thick for pipe sizes 2” (50 mm) and larger. Note: Insulation provided for domestic hot water applications shall have a minimum R-value of 6.0.

3.3 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Provide factory molded insulation or pre-fabricated fittings for all valves, fittings, unions, etc. Valve handles must be extended by the mechanical contractor to accommodate the insulation without reducing the thickness or integrity of the valve insulation.

G. All water test ports shall be accessible from the insulation. In addition, water flow measuring stations require access from insulation to verify sizes and model.

H. Extend piping insulation without interruption through pipe hangers, walls, floors and similar piping penetrations, except where otherwise indicated.

I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" (75 mm) wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" (75 mm) wide vapor barrier tape or band. If using pipe hangers, follow manufacturer's instructions for installation.

J. All exposed pipe insulation, including fittings, above 8'- 0" (2400 mm-0 mm) of finished floor shall have 8 oz. (227 g) fire retardant canvas cover neatly cut and parted seams shall be sealed.

K. All exposed pipe insulation, including fittings, within 8' - 0" (2400 mm-0 mm) of finished floor or within a stairwell, shall be provided with aluminum or PVC protective covers. All edges shall be hemmed and all seams shall be concealed.

L. All exterior piping shall be provided with an embossed aluminum jacket.

M. For all insulated piping 2-1/2" (63 mm) and larger, provide insulated pipe saddles as follows:

1. For domestic hot and cold water piping (up to 250ºF), provide the following:

    a. Minimum 3.75 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.

    b. For cold applications below 75ºF (24ºC) a zero permeability, abuse resistant, vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.

    c. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.

    d. Provide visible inspection sticker at the bottom of each saddle.

    e. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

f. Armacell Armafix Pipe Hangers may be used for cold water piping with flexible elastomeric insulation.

3.4 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping installer for piping insulation application and equipment installer for equipment insulation application. Before preparing piping shop drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.5 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.6 EXISTING INSULATION REPAIR/REPLACEMENT

A. Repair damaged sections of mechanical and plumbing insulation, damaged during this construction period. Insulation shall be as specified herein.

B. Provide new insulation on existing mechanical and plumbing piping where insulation has been removed due to damage or repair.

3.7 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 00

SECTION 220800 - COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

B. Section includes commissioning process requirements for plumbing systems, assemblies, and equipment. This section is intended to supplement and further detail the Commissioning requirements listed in Division 1.

C. Related Sections:

1. Section 019113 - "General Commissioning Requirements"

D. All tasks listed in this section are assumed to be the responsibility of the GC and their Sub-contractors, unless explicitly stated otherwise.

E. The following systems and/or equipment shall be commissioned:

1. Plumbing Systems and Controls

1.2 CONTRACTOR'S RESPONSIBILITIES

A. The contractor’s responsibilities include but are not limited to the following:

1. Perform commissioning tests at the direction of the Commissioning Agent (CA).
2. Attend construction phase commissioning coordination meeting.
3. Provide information requested by the CA for final commissioning documentation.
4. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.3 COMMISSIONING DOCUMENTATION

A. Documentation to be provided by the contractor includes, but is not limited to, the following:

1. Factory testing reports
2. Field testing reports
3. Equipment and system startup reports
4. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
5. Test and inspection reports.
6. Corrective action documents.
7. Completed and signed pre-functional checklists
8. Current Facility Requirements & O&M Plan (see 019113 for details)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CA.

3.2 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CA. Contractor is required to provide personnel who are capable of demonstrating all equipment functionality that is required by the contract documents. This may include, but is not limited to, installing contractor, TAB contractor, controls contractor, and authorized manufacturer’s representatives.

B. Scope of plumbing testing shall include the conditioned common areas and living spaces for this project. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and verify proper response of building automation system controllers and sensors.

D. The CA along with the plumbing Subcontractor, shall prepare detailed testing plans, procedures, and checklists for plumbing systems, subsystems, and equipment.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Provide equipment to simulate loads. Set simulated conditions as directed by the CA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CA may direct that set points be altered when simulating conditions are not practical.

G. The CA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

END OF SECTION 220800

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SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of domestic water piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for domestic water piping systems include the following:

1. Domestic cold-water piping
2. Domestic hot-water piping
3. Exterior water piping

C. Refer to appropriate Division-22 sections for insulation required in connection with domestic water piping; not work of this section.

D. Refer to appropriate Division-02 sections for trenching and backfill required in conjunction with exterior water piping; not work of this section.

E. Trenching and backfill required in conjunction with domestic water piping inside of building foundations is specified in applicable Division-02 and Division-22 sections, and is included as work of this section.

F. Refer to other Division-22 sections for water treatment, (sterilization) not work of this section.

1.2 QUALITY ASSURANCE

A. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems.

B. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code and all other applicable codes and/or Owner's requirements pertaining to plumbing materials, construction and installation of products.

C. ANSI and ASTM Compliance: Comply with applicable standards pertaining to products and installation of domestic water piping systems.

D. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

E. NSF Standard 14 Compliance: Plastic Piping components and related materials.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for domestic water piping systems, materials and products.

B. Shop Drawings: Submit scaled layout drawings as required by Division-22 Section “Basic Plumbing Requirements”.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 Section "Identification for Plumbing Piping and Equipment".

2.3 BASIC PIPE, TUBE, AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Interior Domestic Hot Water Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube.

   a. Wall Thickness: Type L, hard-drawn temper.

   b. Fittings: Wrought-copper, solder-joints.

2. Tube Sizes 2” (50 mm) and Smaller: CPVC CTS SDR 11.

   a. All pipe and fittings to be manufactured from rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1 with a Cell Classification of 24448 (CPVC412) for pipe and 23447 for fittings as per ASTM D 1784 and conform to NSF International Standards 14 and 61. Pipe and fittings to be Copper Tube Size (CTS) manufactured to standard dimension ratio (SDR) 11, rated for 400 psi (2760 kPa) at 73 degrees F and 100 psi (690 kPa) at 180°F (82°C) , with 180°F maximum working temperature, and shall conform to ASTM D 2846. Transition fittings to have brass male or female

connections with integral CPVC socket connections. Brass alloys shall be lead-free and comply with ANSI/NSF Standards 61 and 372. Solvent cement shall conform to ASTM F493. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements.

b. Contractor shall receive approval by local authority having jurisdiction for use of CPVC in plenum rated spaces.

C. Interior Domestic Cold Water Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube.

a. Wall Thickness: Type L, hard-drawn temper.

b. Fittings: Wrought-copper, solder-joints.

2. Tube Size 2" (50 mm) and Smaller: CPVC CTS SDR 11.

a. All pipe and fittings to be manufactured from rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1 with a Cell Classification of 24448 (CPVC412) for pipe and 23447 for fittings as per ASTM D 1784 and conform to NSF International Standards 14 and 61. Pipe and fittings to be Copper Tube Size (CTS) manufactured to standard dimension ratio (SDR) 11, rated for 400 psi (2760 kPa) at 73 degrees F and 100 psi (690 kPa) at 180°F, with 180°F (82°C) maximum working temperature, and shall conform to ASTM D 2846. Transition fittings to have brass male or female connections with integral CPVC socket connections. Brass alloys shall be lead-free and comply with ANSI/NSF Standards 61 and 372. Solvent cement shall conform to ASTM F493. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements.

b. Contractor shall receive approval by local authority having jurisdiction for use of CPVC in plenum rated spaces.

3. Pipe Size 2-1/2" (65 mm) and Larger: Copper pipe.

a. Wall Thickness: Type L, hard-drawn temper.

b. Fittings: Wrought-copper, grooved and solder joints.

4. Pipe Size 2-1/2" (65 mm) and Larger: CPVC Schedule 40. For use on First Floor mains and risers only.

a. All pipe and fittings to be manufactured from rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1 with a Cell Classification of 24448 (CPVC412) for pipe and 23447 for fittings as per ASTM D 1784 and conform to NSF International Standards 14 and 61. Pipe and fittings to be Iron Pipe Size (IPS), rated for 400 psi (2760 kPa) at 73 degrees F and 100 psi (690 kPa) at 180°F (82°C) , with 180°F maximum working temperature, and shall conform to ASTM D 2846. Transition fittings to have brass male or female connections with integral CPVC socket connections. Brass alloys shall be lead-free and comply with ANSI/NSF Standards 61 and 372. Solvent cement shall conform to ASTM F493. Installation to be in

accordance with manufacturer's instructions and all applicable local code requirements.

b. Contractor shall receive approval by local authority having jurisdiction for use of CPVC in plenum rated spaces.

D. Exterior and Below Grade Cold Water Piping:

1. Tube Size 2" (50 mm) and Smaller: Copper tube.

a. Wall Thickness: Type K, soft-annealed temper.

b. Fittings: Wrought-copper, solder-joints.

2. Pipe Size 2-1/2" (65 mm) and Larger: Ductile-iron pipe, with cement-mortar lining.

a. Pipe Weight: Schedule 150.

b. Fittings: Ductile-iron, with rubber-gasket joints.

E. Cold Water Piping to Trap Primers: Type M copper tubing.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 Section "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe escutcheons

2. Low-pressure Y-type pipeline strainers

3. Dielectric fittings

4. Drip pans

5. Pipe sleeves

6. Sleeve seals

2.5 SPECIAL PIPING SPECIALTIES

A. Water Hammer Arresters: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi (1725 kPa), tested and certified in accordance with PDI Standard WH-201.

B. Hose Connection Vacuum Breakers: Provide hose connection vacuum breakers where indicated for back-siphonage protection.

1. Brass construction, suitable for indoor or outdoor use (maximum pressure 125 psi) (maximum pressure 865 kPa).

2. Inlet shall be 3/4" (20 mm) standard female hose thread; outlets shall be 3/4" (20 mm) male hose thread.

3. Provide non-removable feature to prevent unauthorized removal from pipe system or sill cock.

2.6 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports, anchors, and seals complying with Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.

2. Two-bolt riser clamps for vertical piping supports.

3. Concrete inserts, C-clamps, and steel brackets for building attachments.

4. Protection saddles for insulated piping support in hangers.

5. Copper flashings for piping penetrations.

2.7 BASIC VALVES

A. General: Provide valves complying with Division-22 Section "Valves for Plumbing Piping", in accordance with the following listing:

1. Sectional Valves:

   a. 2" (50 mm) and Smaller: Ball Valves.

   b. 2-1/2" (65 mm) and Larger: Butterfly Valves.

2. Shutoff Valves:

   a. 2" (50 mm) and Smaller: Ball Valves.

   b. 2-1/2" (65 mm) and Larger: Butterfly Valves.

3. Drain Valves:

   a. 2" (50 mm) and Smaller: Ball Valves.

4. Incoming Water Service:

   a. All Sizes: OS&Y Gate Valves.

5. Check Valves:

a. All Sizes: Swing Check Valves.

2.8 SPECIAL VALVES

A. General: Special valves required for domestic water piping systems include the following types:

1. Balance Cocks:

a. Soldered Ends 2" (50 mm) and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

2. Hose Bibb:

a. Non-freeze Hose Bibb (HB): Soldered end, bronze body, renewable composition disc, wheel handle, 3/4" (20 mm) solder inlet, 3/4" (20 mm) hose outlet with integral vacuum breaker.

3. Hydrants:

a. Recessed Non-Freeze Wall Hydrants (WH): Cast-bronze box hydrant, polished bronze face plate, automatic draining with ASSE 1052 double check backflow preventer, loose tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" (20 mm) inlet, hose outlet. Wall hydrant shall be Woodford Model B67 or equivalent.

2.9 PUMPS

A. General: Provide pumps complying with Division-22 Section "Plumbing Pumps", in accordance with the following listing:

1. Water pressure booster

2.10 BACKFLOW PREVENTERS (DOMESTIC WATER)

A. General: Provide reduced pressure principle backflow preventers consisting of assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventers shall include test cocks, and pressure-differential relief valve located between two (2) positive seating check valves. Construct in accordance with ASSE Standard 1013.

B. Backflow preventer size shall not be less than the connected line size indicated.

2.11 PRESSURE REGULATING VALVES

A. General: Provide pressure regulating valves, single seated, direct operated type, bronze body, integral strainer, complying with requirements of ANSI/ASSE Standard 1003. Size for maximum flow rate and inlet and outlet pressures indicated on drawings.

2.12 BASIC EXPANSION COMPENSATION

A. General: Provide expansion compensation products complying with Division-22 Section "Expansion Compensation for Plumbing Piping", in accordance with the following listing:

1. Pipe alignment guides.

2.13 BASIC METERS AND GAUGES

A. General: Provide meters and gauges complying with Division-22 Section "Meters and Gauges for Plumbing Piping".

2.14 WATER METER

A. General: Provide water meter and related piping conforming to applicable local utility company regulations and AWWA standards.

B. General: Water meter provided by Montgomery County Department of Public Works. Provide roughing-in and bypass for meter in accordance with Montgomery County Department of Public Works requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 Section “Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF DOMESTIC WATER DISTRIBUTION PIPING

A. General: Install water distribution piping in accordance with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems".

B. Domestic cold water tubing serving trap primers located below floor slab shall be installed in 2" (50 mm) PVC conduit.

3.3 INSTALLATION OF EXTERIOR WATER PIPING

A. General: Install exterior water service piping system in compliance with local governing regulations.

B. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide gate valve at water service entry inside building; strainer, pressure gage, test tee with valve.

C. Copper Tube: Install in accordance with recommended procedures of the Copper Development Association.

D. Ductile-Iron Pipe: Install in accordance with ANSI/AWWA C-60.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 Section "Piping Specialties for Plumbing Systems".

B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.5 INSTALLATION OF SUPPORTS, ANCHORS, AND SEALS

A. Install supports, anchors, and seals in accordance with Division-22 Section "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF VALVES

A. Install valves in accordance with Division-22 Section "Valves for Plumbing Piping".

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two (2) or more plumbing fixtures or equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

E. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

F. Hose Bibbs: Install where indicated, with vacuum breaker.

G. Hydrants: Installed where indicated, in accordance with manufacturer's installation instructions.

3.7 INSTALLATION OF PUMPS

A. Install pumps in accordance with Division-22 Section "Plumbing Pumps".

3.8 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated, and where required by International Plumbing Code. Pipe relief outlet to nearest floor drain thru air gap fitting.

3.9 INSTALLATION OF PRESSURE REGULATING VALVES

A. Install pressure regulating valves where required to reduce the pressure below the code allowable pressure. Provide inlet and outlet shutoff valves, and globe valve bypass. Provide pressure gage on valve inlet outlet.

3.10 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

A. Install expansion compensation products in accordance with Division-22 Section "Expansion Compensation for Plumbing Piping".

3.11 INSTALLATION OF METERS AND GAUGES

A. Install meters and gauges in accordance with Division-22 Section "Meters and Gauges for Plumbing Piping".

3.12 INSTALLATION OF WATER METER

A. Install water meter in accordance with local utility company's installation instructions, and comply with requirements.

3.13 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts of sizes indicated, but in no case smaller than required by International Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.14 SPARE PARTS

A. Furnish to the Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION 22 11 16

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SECTION 22 11 23 - PLUMBING PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing pumps work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of pumps specified in this section include the following:

1. Water Pressure Booster Systems

2. Elevator Sump Pumps

3. Submersible Sump Pumps

4. Gas Booster Systems (To Be Determined)

C. Refer to other Division-22 sections for insulation of pump housings; not work of this section.

D. Refer to other Division-22 sections for vibration control of plumbing pumps; not work of this section.

E. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:

1. Control wiring between field-installed controls, indicating devices, and pump control panels.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".

2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".

3. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

4. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with Sump and Sewage Pump Manufacturer's Association (SSPMA) and provide certified rating seal.

5. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

6. Department of Energy (DOE) compliance: Pump manufacturer shall comply with US Department of Energy (DOE) energy conservation standard for “clean water pumps” 1-200 horsepower, less than 459 feet of head and greater than 25 gpm. These pumps shall be evaluated using the Pump Energy Index (PEI) of equal to or lesser than 1.0. The PEI number shall appear on the pump name plate and be available for the record at http://er.pumps.org.

B. Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and spare parts lists for each type of pump, control, and accessory; including "troubleshooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle plumbing pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged plumbing pumps or components; replace with new.

B. Store plumbing pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading plumbing pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 PUMPS

A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump are listed in pump schedule. Provide pumps of same type by same manufacturer.

2.2 IN-LINE RECIRCULATION PUMPS

A. General: Provide in-line recirculation pumps where indicated, and of capacities as scheduled.

B. Type: Horizontal, oil-lubricated, designed for 125 psi (850 kPa) working pressure, 225°F (107°C) continuous water temperature, and specifically designed for quiet operation.

C. Body: All bronze construction.

D. Shaft: Stainless steel, ground and polished, integral thrust collar.

E. Bearings: Two horizontal sleeve bearings designed to circulate oil.

F. Seal: Mechanical, with carbon seal face rotating against ceramic seat.

G. Motor: Non-overloading at any point on pump curve, open, dripproof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

H. Coupling: One-piece spring coupling.

2.3 WATER PRESSURE BOOSTER SYSTEM

A. General: Provide factory-fabricated and tested water pressure booster system consisting of two centrifugal pumps, power and control panels, instrumentation, and operating controls, main power disconnect, single point connection, mounted on fabricated welded steel base assembly. Provide size as indicated, capacities as scheduled.

B. Pumps: Provide two (2) variable speed, end-suction design, cast iron, bronze fitted centrifugal pumps with mechanical shaft seals. Mount pumps on vibration isolators. Provide temperature probe and electric purge valve immediately upstream of each pressure reducing valve. Provide drip-proof motors.

C. System Controls: Maintain system pressure with pilot-operated diagram type combination pressure regulating and non-slam check valve on each pump discharge line.

1. Provide low system pressure switch located on discharge header to sense drop in system pressure, and to activate alarm and automatically start standby pump.

2. Provide adjustable vane type flow switch to switch to sequence lag pump.

D. Control Panel: Provide UL-listed, NEMA 12, hinged door, lockable control panel containing the following:

1. For Each Pump:

a. Fused disconnect switch

b. Motor starter with 3-leg overload protection

c. Running light

d. Multiple position motor control switch

e. Discharge pressure gage

2. For System:

a. 115V control transformer

b. Control power switch

c. Indicating lights

d. Relays

e. Visual alarm system

f. Suction pressure gage

E. Prefabrication: Factory-prefabricate booster system, mount all components on common structural stand. Provide interconnecting piping, isolation valves on suction and discharge of each pump, suction and discharge piping manifolds, shutoff cocks for gages and pressure switches, and factory-wiring.

F. Factory-Test: Provide electrical and hydraulic test on assembled unit prior to shipment. Provide system operating flow test from 0 to 100% design flow rate at scheduled suction and discharge pressure conditions.

2.4 ELEVATOR SUMP PUMPS

A. General: Provide sump pumps in all elevator pits with the capacities as scheduled.

B. Type: Submersible sump pump with a stainless steel oil sensor probe mounted on the pump, 2” discharge, double mechanical seal, cast iron impeller with check valve.

C. Control Panel: Provide control panel in a NEMA 4X fiberglass enclosure with visual and audible alarm, auxiliary contact, overcurrent relay, terminal board, RMS relay, magnetic contactor, alarm silence, pump overload light and horn.

D. Provide junction box with multi-pin connector and power cord of length as required to connect to control panel.

E. Provide Stancor elevator pit sump pump with “Oil Minder” control system or equivalent.

2.5 SUBMERSIBLE SUMP PUMPS

A. General: Provide submersible sump pumps as indicated, of size and capacity as scheduled.

B. Pump: Cast-iron shell, bronze impeller, stainless steel shaft, factory-sealed grease lubricated ball bearings, ceramic mechanical seal, and perforated steel strainer.

C. Motor: Hermetically sealed, capacitor-start, with built-up overload protection, electrical characteristics as scheduled. Provide 10' (3 m) of 3-conductor PVC cord and molded grounding plug.

D. Controls: Float-operated mercury switch.

E. Basin: Fiberglass construction of indicated dimensions, with inlet connections of size and location as indicated. Maintain minimum of 3' (900 mm) depth below lowest inlet invert.

F. Cover: Cast-iron or steel circular cover with manhole or handhole opening, depending on diameter. Provide openings for pump, control rod, and discharge piping.

G. Controls: Provide NEMA 1 motor-mounted float switch complete with float, float rod, and buttons.

H.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PUMPS

A. General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.

B. Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Support: Refer to Division-22 section "Vibration Control for Plumbing Piping and Equipment" for support and mounting requirements of plumbing pumps.

D. Basins: Install sump pump basins in indicated locations and connect to sewer inlets. Brace interior of basin in accordance with manufacturer's instructions, to prevent

distortion or collapse during concrete placement. Refer to Architectural Division for concrete work; not work of this section. Set cover over basin, fasten to top flange of basin. Install so cover is flush with finished floor.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Piping Connections: Refer to Division-22 plumbing piping sections. Provide piping, valves, accessories, gages, supports, and flexible connections as indicated.

3.3 ADJUSTING AND CLEANING

A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

B. Start-up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 11 23

SECTION 22 13 16 - SOIL, WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of soil and waste piping system work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for soil and waste piping systems include the following:

1. Aboveground soil, waste and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps, and connections to fixtures and drains.

2. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, terminating at connection to sanitary sewers five feet outside of foundation wall.

C. Exterior sanitary sewer system is specified in applicable Division-02 sections, and is included as work of this section.

D. Refer to appropriate Division-22 sections for insulation required in connection with soil and waste piping; not work of this section.

E. Trenching and backfilling required in conjunction with underground building drain piping is specified in applicable Division-22 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems for a minimum of five (5) years.

C. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code pertaining to plumbing materials, construction and installation of products.

D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

E. PDI Compliance: Comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for soil and waste piping systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of soil and waste pipe and fittings showing interface and spatial relationship between piping, ductwork and proximate equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cleanouts, drains and valves which may be incorporated in the Work include the following:

1. Josam
2. J. R. Smith
3. Zurn
4. Mifab
5. Wade
6. Watts Drainage

2.2 SOIL, WASTE AND VENT PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste piping systems. Where more than one (1) type of materials or products is indicated, selection is Installer's option.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 section, “Identification for Plumbing Piping and Equipment”.

2.4 BASIC PIPE, TUBE, AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Above Ground Piping Within Buildings:

1. Tube Size 8" (200 mm) and Smaller: Copper tube.

    a. Wall Thickness: Type DWV.

    b. Fittings: Cast-bronze, drainage pattern, solder-joint.

2. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub-and-spigot soil pipe.

    a. Pipe and fittings to be service weight and shall comply with ASTM A 74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

    b. Fittings: Compression gasket joints meeting the requirements of ASTM C-564, or lead and oakum joints.

3. Pipe Size 15" (400 mm) and Smaller: Hubless cast-iron soil pipe.

    a. Pipe and fittings shall comply with CISPI 301 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

    b. Fittings: Hubless couplings shall comply with CISPI Standard 310.

    c. For buildings less than ten (10) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the second floor level.

    d. For buildings more than ten (10), but less than twenty (20) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the fourth floor level.

    e. Provide heavy duty shielded couplings for all aboveground piping.

    f. Heavy Duty Shielded Couplings: Heavy duty couplings shall meet the requirements of ASTM C 1540 and gaskets shall meet the requirements of ASTM 564.

    g. Available Manufacturers: Subject to compliance with requirements, manufacturers offering couplings which may be incorporated in the Work include the following:

        1) Anaco/Husky

        2) Mission Rubber

        3) Tyler Coupling

        4) Ideal

4. Pipe Size 16” (400 mm) and Smaller: PVC Schedule 40.

    a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a Cell Class of 12454 per ASTM D 1784 and conform

with NSF International Standard 14. Pipe shall be Schedule 40, solid wall, iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cements shall conform to ASTM D 2564. Primers shall conform to ASTM F 656. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Foam core, cellular core, etc. shall not be accepted.

C. Underground Building Drain Piping:

1. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub and spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A 74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

   b. Fittings: Compression gasket joints meeting the requirements of ASTM C 564, or lead and oakum joints.

2. Pipe Size 16" (400 mm) and Smaller: PVC Schedule 40.

   a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 40, solid wall, iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cements shall conform to ASTM D 2564. Primers shall conform to ASTM F 656. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Foam core, cellular core, etc. shall not be accepted.

2.5 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 section "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe Escutcheons

2. Vandal-Proof Vent Caps

3. Pipe Sleeves

4. Sleeve Seals

2.6 SPECIAL PIPING SPECIALTIES

A. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

B. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks.

2.7 SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 sections in accordance with the following listing:

1. Adjustable steel clevises, steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.

2. Two-bolt riser clamps for vertical piping supports.

3. Concrete inserts, C-clamps, and steel brackets for building attachments.

4. Copper flashings for piping penetrations.

2.8 SPECIAL VALVES

A. General: Special valves required for soil and waste piping systems include the following types:

1. Backwater Valves: Cast-iron body, bronze backwater valve assembly swing check type, with cleanout access cover. Provide ends to suit piping material; bolted cover.

2.9 SPECIAL EXPANSION COMPENSATION

A. General: Special expansion compensation products required for soil and waste piping systems include the following types:

1. Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.

2.10 CLEANOUTS

A. General: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanouts in Piping: Cast-iron cleanout ferrule with bronze countersunk plug, suitable for no-hub applications.

C. Cleanouts in finished walls and partitions shall be similar to cleanouts in piping. Provide round polished stainless steel wall access cover with screw. Finish as per Architect.

D. Cleanouts in Tiled Floor: Cast-iron internal gasketed cleanout plug and adjustable housing with secured scoriated square satin Nickel Alloy top.

E. Cleanouts in Non-Tiled Floor: Similar to tiled floor type with a secured scoriated round satin Nickel Alloy top.

2.11 FLOOR DRAINS

A. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein:

B. Toilet Room Floor Drain: Cast-iron body and flashing collar, Nickel Alloy adjustable strainer head with secured square grate, with the following features:

1. Heel-proof grate.

2. 1/2" (13 mm) trap priming connection.

3. Bottom outlet, no-hub for aboveground piping or, bottom outlet, hub and spigot for underground piping.

C. Mechanical Room Floor Drain: Cast-iron body and flashing collar, heavy duty loose set grate (minimum 9" diameter) (minimum 225 mm diameter), with the following features:

1. Double drainage flange with weep holes.

2. Sediment bucket.

3. Adjustable extension.

4. 1/2" (13 mm) trap priming connection.

5. Flat bottom strainer.

6. Deep body.

7. Bottom outlet, no-hub for aboveground piping or, bottom outlet, hub and spigot for underground piping.

8. Provide funnels for drains receiving A/C condensate or elsewhere as indicated.

D. General Purpose Floor Drain: Cast-iron body and flashing collar, Nickel Alloy adjustable strainer head with secured square grate, with the following features:

1. Sediment bucket.

2. Heel-proof grate.

3. 1/2" (13 mm) trap priming connection.

4. Bottom outlet, no-hub for aboveground piping or, bottom outlet hub and spigot for underground piping.

E. Cast-Iron Trench Drains: Cast-iron shallow hub body and loose set cast-iron grate 12" (300 mm) wide grate, assembled in standard lengths for total length as indicated, with the following features:

1. Sediment bucket.

2. Flashing device.

3. Vandal-proof grate.

4. Bottom outlet, no-hub for aboveground piping or, bottom outlet, hub and spigot for underground piping.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF SOIL AND WASTE ABOVE GROUND PIPING

A. General: Install soil and waste piping in accordance with Division-22 section "Pipe, Tube, and Fittings for Plumbing Systems", and with International Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

A. General: Install underground building drains as indicated and in accordance with International Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Temporarily cover end of uncompleted piping at end of day or whenever work stops.

1. Install soil and vent piping pitched to drain at minimum slope of 1/8" per foot (10 mm per meter) (1%). Where possible 1/4" per foot (20 mm per meter) (2%) shall be provided.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 section "Piping Specialties for Plumbing Systems".

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors in accordance with Division-22 section "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF SPECIAL VALVES

A. Backwater Valves: Install in sanitary building drain piping serving fixtures located below curb line and as required by International Plumbing Code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover, and of adequate size to remove valve cover for service. Install in such a manner to provide maximum 1/4" (6 mm) clearance between flapper and seat for air circulation.

3.7 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion Joints: Install expansion joints on vertical risers as indicated, or as required by International Plumbing Code.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts: Install in sanitary above ground piping and sanitary building drain piping as indicated, as required by International Plumbing Code; and at each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet (15 m) for piping 4" (100 mm) and smaller and 75 feet (23 m) for larger piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.9 INSTALLATION OF FLOOR DRAINS

A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

1. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.

2. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

4. Position drains so that they are accessible and easy to maintain.

3.10 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by International Plumbing Code.

1. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.11 PIPING TESTS

A. Test soil and waste piping system in accordance with requirements of Division-22 section "Pipe, Tube and Fittings for Plumbing Systems".

END OF SECTION 22 13 16

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SECTION 22 14 13 - STORM WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of storm water piping work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for storm water piping include the following:

1. Storm water piping from conductor piping and area drains to storm sewers five feet outside of foundation wall.

2. Foundation drainage tile and pipes.

3. Air conditioning condensate piping.

4. Sump pump discharge piping.

C. Exterior storm water piping is specified in applicable Division-2 sections, and is included as work of this section.

D. Refer to appropriate Division-22 sections for insulation required in conjunction with storm water piping; not work of this section.

E. Trenching and backfill required in conjunction with storm building drain piping is specified in applicable Division-22 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire system shall be installed by trained workmen skilled in the installation of such systems for a minimum of five (5) years.

C. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code pertaining to plumbing materials, construction and installation of products.

D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil, waste and storm water piping systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for storm water piping systems materials and products.

B. Shop Drawings: Submit scaled layout drawings of installed storm water pipe and fittings showing interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cleanouts, drains and valves which may be incorporated in the Work include the following:

1. Josam
2. J. R. Smith
3. Zurn
4. Wade
5. Mifab
6. Watts Drainage

2.2 STORM WATER PIPING MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in storm water piping systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 Section "Identification for Plumbing Piping and Equipment".

2.4 BASIC PIPE, TUBE AND FITTINGS

A. General: Provide pipe, tube, and fittings complying with Division-22 Section "Pipe, Tube, and Fittings for Plumbing Systems", in accordance with the following listing:

B. Above Ground Piping Within Buildings:

1. Tube Size 8" (200 mm) and Smaller: Copper tube.

    a. Wall Thickness: Type DWV.

b. Fittings: Cast-bronze, drainage pattern, solder-joints.

2. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub-and-spigot soil pipe.

   a. Pipe and fittings to be service weight and shall comply with ASTM A-74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

   b. Fittings: Compression gasket joints meeting the requirements of ASTM C 564, or lead and oakum joints.

3. Pipe Size 15" (400 mm) and Smaller: Hubless cast-iron soil pipe.

   a. Pipe and fittings shall comply with CISPI 301 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

   b. Fittings: Hubless couplings shall comply with CISPI Standard 310.

   c. For buildings less than ten (10) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the second floor level.

   d. For buildings more than ten (10), but less than twenty (20) floors in height, provide heavy duty shielded couplings for all aboveground piping up to the fourth floor level.

   e. Provide heavy duty shielded couplings for all aboveground piping.

   f. Heavy Duty Shielded Couplings: Heavy duty couplings shall meet the requirements of ASTM C 1540 and gaskets shall meet the requirements of ASTM 564.

   g. Available Manufacturers: Subject to compliance with requirements, manufacturers offering couplings which may be incorporated in the Work include the following:

      1) Anaco/Husky

      2) Mission Rubber

      3) Tyler Coupling

      4) Ideal

4. Pipe Size 16” (400 mm) and Smaller: PVC Schedule 40.

   a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 40, solid wall, iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866. Installation to be in accordance with manufacturer’s instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cements shall conform to ASTM D 2564. Primers shall conform to ASTM F

656. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Foam core, cellular core, etc. shall not be accepted.

C. Underground Drain Piping:

1. Pipe Size 15" (400 mm) and Smaller: Cast-iron hub and spigot soil pipe.

a. Pipe and fittings to be service weight and shall comply with ASTM A 74 and bear the collective mark of the Cast Iron Soil Pipe Institute (CISPI).

b. Fittings: Compression gasket joints meeting the requirements of ASTM C 564, or lead and oakum joints.

2. Pipe Size 16" (400 mm) and Smaller: PVC Schedule 40.

a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 40, solid wall, iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Molded fittings shall conform to ASTM D 2665. Fabricated fittings shall conform to ASTM F 1866. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cements shall conform to ASTM D 2564. Primers shall conform to ASTM F 656. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Foam core, cellular core, etc. shall not be accepted.

D. Foundation Drainage Tile and Pipe Fittings, and Accessories:

1. Corrugated High Density Polyethylene Drainage (Perforated) Pipe: Piping shall be single wall and perforated with holes, applicable for storm drainage.

2. Fittings for Accessories for Drainage Tile and Pipe: Unless otherwise indicated, match and of same material as pipe units; comply with same standards, where applicable, except fittings need not be perforated where pipe is required to be perforated.

E. Air Conditioning Condensate (above floor/roof):

1. 2" (50 mm) and Smaller: Copper.

a. Wall Thickness: Type M.

b. Fittings: Solder-joint.

2. All sizes: PVC Schedule 80.

a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 80, solid wall, iron pipe size (IPS) conforming to ASTM D 1785. Molded fittings shall

conform to ASTM D 2467. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2774 and ASTM F 1668. Solvent cements and primers shall conform to ASTM D 2564. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements.

b. PVC shall not be used in plenum rated spaces.

F. Sump Pump Discharge:

1. 2" (50 mm) and Smaller: Copper.

a. Wall Thickness: Type M.

b. Fittings: Solder-joint.

2. All sizes: PVC Schedule 80.

a. Pipe and fittings shall be manufactured from virgin rigid polyvinyl chloride (PVC) compound with a cell class of 12454 per ASTM D 1784 and conform with NSF International Standard 14. Pipe shall be Schedule 80, solid wall, iron pipe size (IPS) conforming to ASTM D 1785. Molded fittings shall conform to ASTM D 2467. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements. Buried Pipe to be installed in accordance with ASTM D 2774 and ASTM F 1668. Solvent cements and primers shall conform to ASTM D 2564. Installation to be in accordance with manufacturer's instructions and all applicable local code requirements.

2.5 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 Section, "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe Escutcheons

2. Drip-Pans

3. Pipe Sleeves

4. Sleeve Seals

2.6 SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 Section, "Hangers and Supports for Plumbing Piping and Equipment".

2.7 SPECIAL VALVES

A. General: Special valves required for storm water piping systems include the following types:

1. Backwater Valves: Cast-iron body, bronze backwater valve assembly swing check type, with cleanout access cover. Provide ends to suit piping material; bolted cover.

2.8 SPECIAL EXPANSION COMPENSATION

A. General: Special expansion compensation products required for storm water piping systems include the following types:

1. Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.

2.9 SPECIAL PIPING SPECIALTIES

A. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

2.10 CLEANOUTS

A. General: Provide factory-fabricated cleanouts of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanouts in Piping: Cast-iron cleanout ferrule with bronze countersunk plug, suitable for no-hub applications.

C. Cleanouts in finished walls and partitions shall be similar to cleanouts in piping. Provide round polished stainless steel wall access cover with screw. Finish as per Architect.

D. Cleanouts in Tiled Floor: Cast-iron internal gasketed cleanout plug and adjustable housing with secured scoriated square satin Nickel Alloy top.

E. Cleanouts In Non-Tiled Floor: Similar to tiled floor type with a secured scoriated round satin Nickel Alloy top.

2.11 ROOF DRAINS

A. General: Provide roof drains of size as indicated on drawings; and type, including features, as specified herein:

1. Roof Drain: Cast-iron body and combined flashing collar, cast-iron dome, integral gravel stop with following features:

a. Underdeck clamp with support ring.

b. Adjustable extension.

c. Large sump with anchor flange.

d. Vandal-proof dome.

e. Bottom outlet, no-hub.

f. Perforated gravel guard, on ballasted roofs

g. Overflow ring dam for overflow roof drains; coordinate height with structural engineer

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-16 Section "Identification for Plumbing Piping and Equipment".

3.2 INSTALLATION OF STORM WATER PIPING ABOVE GROUND

A. General: Install storm water piping in accordance with Division-22 Section, "Pipe, Tube, and Fittings for Plumbing Systems", and with International Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

A. General: Install storm building drains as indicated and in accordance with International Plumbing Code. Lay storm building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

B. Air conditioning (A/C) condensate piping shall be extended from all A/C condensate source equipment (air handling units, fan coil units, split system A/C units, etc.) and connected to the nearest storm water pipe/drain location. Size per manufacturer.

C. Install storm water piping pitched to drain at minimum slope of 1/8" per foot (10 mm per meter) (1%). Where possible, 1/4" per foot (20 mm per meter) (2%) shall be provided.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division-22 Section, "Piping Specialties for Plumbing Systems".

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors in accordance with Division-22 Section, "Hangers and Supports for Plumbing Piping and Equipment".

3.6 INSTALLATION OF SPECIAL VALVES

A. Backwater Valves: Install in storm water piping as indicated, and as required by International Plumbing Code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover, and of adequate size to remove valve cover for service. Install in such a manner to provide a maximum 1/4" (6 mm) clearance between flapper and seat for air circulation.

3.7 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion Joints: Install expansion joints on vertical risers as indicated, or as required by International Plumbing Code.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts: Install in conductor piping and storm building drain piping as indicated, as required by International Plumbing Code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet (15 m) for piping 4" (100 mm) and smaller and 75 feet (23 m) for larger piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.9 INSTALLATION OF DRAINS

A. General: Install drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

C. Coordinate with storm water piping as necessary to interface drains with drainage piping systems.

1. Install drains at low points of surface areas to be drained, or as indicated.

2. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

3.10 PIPING TESTS

A. Test storm water piping system in accordance with requirements of Division-23 Section, "Testing, Adjusting and Balancing".

END OF SECTION 22 14 13

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SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing equipment work is indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section.

B. Types of plumbing equipment required for project include the following:

1. Domestic Water Heaters:
    a. Commercial gas-fired water heaters
2. Domestic Water Expansion Tanks
3. Interceptors:
    a. Oil/water interceptors

1.2 QUALITY ASSURANCE

A. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

B. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

C. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) "National Fuel Gas Code", as applicable to installation of gas-fired water heaters.

D. ANSI Testing Standard: Water heaters shall comply with ANSI Z21.10.3 testing standard.

E. AGA and NSF Labels: Provide water heaters which have been listed and labeled by American Gas Association and National Sanitation Foundation.

F. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:

1. Commercial water heaters
2. Domestic water expansion tank

G. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

H. Water heaters shall comply with the Energy Policy Act of 2005 (EPACT-2005) and ASHRAE Standard 90.1b regarding energy efficiency. Minimum thermal efficiency shall be 78%.

I. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER HEATERS

A. Commercial Gas-Fired Water Heaters:

1. General: Provide commercial gas-fired water heaters of size and capacity as indicated on schedule. Comply with ANSI/ASHRAE/IES 90A for energy efficiency. Provide certification of design by AGA under Volume III tests for commercial water heaters. Provide approval by NSF.

2. Heater: Working pressure of 150 psi (1020 kPa); boiler-type hand hole cleanout; magnesium anode rod; 3/4" (20 mm) tapping for relief valve; glass lining on internal surfaces exposed to water.

3. Safety Controls: Equip with automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank; and pilot safety shutoff.

4. Draft Hood: Equip with AGA certified draft hood.

5. Jacket: Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish over bonderized undercoating.

6. Warranty: Furnish three (3) year limited warranty for tank leakage.

7. Accessories: Provide brass drain valve; 3/4" (20 mm) pressure and temperature relief valve; radiant floor shield.

8. Controls: Provide gas pressure regulator with atmospheric vent; pilot gas regulator; thermostat.

2.2 DOMESTIC WATER EXPANSION TANK

A. Commercial Potable Water Expansion Tank:

1. General: Provide commercial non-ASME potable water expansion tank suitable for use with potable water systems and with all wetted surfaces/components of the Food and Drug Administration approved materials.

2. Removable and replaceable heavy-duty butyl bladder.

3. Suitable for operating temperature up to and including 240°F (116°C).

4. Working pressure 150 PSIG (1034.4 Kpa) minimum. Shall be pre-charged to capacities as shown in schedule or shall be pre-charged to 60 PSI if no schedule is shown on the drawings.

5. Shall have charging valve with pressure gauge, lifting ring and 1" NPT drain connection on the side and on the bottom with plugs. Shall be suitable for horizontal or vertical mounting.

6. Acceptance capacities shall be as shown on the drawings.

2.3 INTERCEPTORS

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER HEATERS

A. Water Heaters (General):

1. General: Install water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

2. Support: Set units on concrete pads, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.

3. Piping: Connect hot and cold water piping to units with unions. Provide shut off valve on cold water line. Connect recirculating water line to unit with shut off valve, check valve, and union.

3.2 INSTALLATION OF DOMESTIC WATER EXPANSION TANK

A. Domestic water expansion tank shall be securely suspended from the structure above or shall be pad mounted on a 4" high concrete pad.

B. Tie piping connection into cold water feed line to domestic water heater between shut-off valve and inlet of domestic water heater, or as indicated on the drawings. Provide shut-off valve and union on connecting pipe to allow service and inspection of expansion tank.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of plumbing fixture work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of plumbing fixtures specified in this section include the following:

1. Water Closets
2. Lavatories
3. Sinks
4. Mop Basins
5. Electric Water Coolers

C. Refer to Division-22 sections for potable water systems used in conjunction with plumbing fixtures; not work of this section.

D. Refer to Division-22 sections for soil and waste systems used in conjunction with plumbing fixtures; not work of this section.

E. Refer to Division-26 sections for field-installed electrical wiring required for water coolers and other plumbing fixtures; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Plumbing Fixture Standards: Comply with applicable portions of National Standard Plumbing Code pertaining to materials and installation of plumbing fixtures.
2. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
3. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.

4. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.

5. UL Compliance: Construct water coolers in accordance with UL Standards and provide UL listing and label.

6. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems".

7. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.

8. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".

    a. Comply with Public Law 90-480, known as the Architectural Barriers Act of 1968.

9. ADA Compliance: Comply with provisions set forth in the "Americans with Disabilities Act Accessibility Guidelines."

10. Lead Free Compliance: All components associated with potable water systems (including, but not limited to, valves, end use devices/fixtures, pipe, pipe fittings, solder/flux, etc.) shall be “lead-free” in accordance with all local, state and federal codes, as well as NSF/ANSI 372 (NSF 61-G).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages.

C. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.

B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type of fixture unless otherwise noted, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, and as required for complete installation.

Where more than one type is indicated, selection is Installer's option. All fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

L-1 - Lavatory – Wall-mounted, Vitreous china, bowl dimension 15-1/2” x 13-1/2” (520 mm x 540 mm) x 5” deep (127 mm), recessed self-draining deck, concealed arm or wall support, rear overflow, center hole. Fixture shall be just American Standard “Murro Universal Design” Model 0955.001EC and 0059.020EC (shroud) or equivalent. Faucet shall be American Standard Selectronic Cast Proximity Metering Faucet with Battery, WaterSense Labeled.

S-1 - Single Compartment Sink (Common Area): 18" x 14" (457 mm x 355 mm) bowl dimensions, 6-3/8” deep, 18-gauge (1.3 mm) type 304 stainless steel single hole compartment sink with rear center drain. Provide high gooseneck single handle deck mounted faucet with pulldown spray with 68” braided hose, classic stainless-steel finish, 1.5 gpm (.12 L/s) (max) aerator, chrome basket strainer, flexible supplies, tailpiece and cast brass P-trap. Sink shall be Just SL-ADA-1921-A-65-J. Faucet shall be CFG Edgestone 46201.

EWC-1 - Electric Water Cooler with Bottle Filler – Bi-Level Wall Mounted - ADA Compliant, non-filtered Refrigerated: Stainless steel, Antimicrobial, Green Ticker, Hands Free, Laminar Flow, Real Drain. Furnished with Flexi-Guard Safety Bubbler, Electronic Bottle Filler Sensor with mechanical front bubbler button activation. Unit shall be UL Certified. Unit shall be Elkay Model EZWS-ERPBM28K with wall mounting plate. Electric water cooler shall be capable of producing 8 gph (80°F-50°F) at 115V, 5A rating.

MB-1 - Mop Basin - Floor Mounted: One piece, white molded from high impact resistant Durastone structural fiberglass, 24" x 24" x 10" deep, factory installed integral drain body with stainless steel strainer. Provide Mustee Duraguard stainless steel wall plates, Fiat 24” vinyl bumper guards, wall mounted faucet with vacuum breaker spout, Mustee mop hanger and service hose and hose holder. Mop sink shall be Mustee Model 63M. Faucet shall be Moen Model 8230 or equivalent.

WC-1 - Water Closet - Flushometer Valve: Vitreous china, floor mounted, water saver toilet (1.28 gal/flush) (4.9 L /flush), High efficiency, low consumption, Powerful direct-fed siphon jet action, elongated bowl with open front seat, 1-1/2" (40 mm) top spud with Sloan: Royal II #111-1.28-CO flush valve (complete with VBF-72-A trap primer where indicated on drawings) and wall brackets. American Standard "Madera FloWise 15” Height" water closet or equivalent.

WC-2 - Water Closet - Flushometer Valve – ADA Compliant: Vitreous china, floor mounted, high efficiency, low consumption toilet (1.28 gal/flush) (4.9 L /flush) with

powerful direct-fed siphon jet action, elongated bowl with open front seat, seat height 16-1/2", 1-1/2" (40 mm) top spud with Sloan: Royal II #111-1.28 flush valve (complete with VBF-72-A trap primer where indicated on drawings) and wall brackets. American Standard "Madera FloWise 16-1/2 height" water closet or equivalent.

WC-3 – Water Closet – Flushometer Valve – Vitreous china, floor mounted, high efficiency, low consumption toilet (1.28 gal/flush) (4.9 L/flush) with siphon jet action, 10-1/4" rim height, elongated bowl, fully glazed trapway, 1-1/2" inlet top spud with Sloan: Royal II #111-1.28 flush valve (complete with VBF-72-A trap primer were indicated on drawings) and wall brackets. American Standard Baby DeVoro 2282.001 or equivalent.

B. All plumbing fixtures indicated to be ADA compliant on the mechanical or architectural drawings shall comply with the "Americans with Disabilities Act Accessibility Guidelines". ADA compliant plumbing fixtures shall meet the latest ADA requirements and installation guidelines shall include, but not be limited to, the following:

Water Closets: Top of seat greater than 17 inches (425 mm) but not to exceed 19" (475 mm) above finished floor. Flush valve not to exceed 44" (1100 mm) above finished floor.

Lavatories: Top of rim or counter shall not exceed 34" (850 mm) above finished floor. Faucets may be lever operated, push button or electronically controlled; however, the faucet must remain open for a minimum of 10 seconds. Faucets also must not require more than five pounds of force to activate the control, and the control must be operable without tight grasping, pinching or twisting of the wrist. Where piping is exposed beneath the lavatory, provide manufactured premolded insulated pipe for exposed hot water, cold water and sanitary drain piping; Lavguard or equivalent.

Water Coolers: Waterspout height shall not exceed 36" (900 mm) above finished floor.

2.2 MATERIALS

A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541 Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541 specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

D. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper.

1. Finish: No. 4, bright, directional polish on exposed surfaces.

E. Steel Sheets for Baked Enamel Finish: ASTM A591, coating Class C, galvanized-bonderized.

F. Steel Sheets for Porcelain Enamel Finish: ASTM A424, commercial quality, Type I.

G. Galvanized Steel Sheet: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment.

H. Aluminum: ASTM B209/B221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.

I. Plastic Laminate: NEMA LD3, general purpose high pressure type, 0.050" thick, smooth (non-textured) white unless another texture and color are indicated or selected by the Owner.

J. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

K. Fiberglass: ANSI Z124, smooth surfaced, with color selected by the Owner.

L. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

1. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

B. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.

C. Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as required.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated sheet steel escutcheons with friction clips.

F. Aerators: Provide aerators of types approved by the Owner, and complying with flow constrictions, hereinbefore specified.

G. Comply with additional fixture requirements contained in fixture schedule indicated on the Drawings.

2.4 TRAP PRIMERS

A. Prime all floor drain traps with trap seal primer valve having integral vacuum breaker.

B. Install primer valve in cold water service line to nearest plumbing fixture and extend in concealed copper piping to trap.

C. Provide automatic timer operated trap priming systems in the mechanical utility rooms where indicated and connect to all floor drains associated with mechanical utility area.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PLUMBING FIXTURES

A. General: Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of National Standard Plumbing Code pertaining to installation of plumbing fixtures.

B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

C. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by the Owner. Remove cracked or dented units and replace with new units.

3.4 ADJUSTING AND CLEANING

A. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation.

B. Adjust water pressure at water coolers, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

C. Adjust or replace washers to prevent leaks at faucets and stops.

3.5 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to the Owner with receipt. Furnish one (1) device for every ten (10) units.

END OF SECTION 22 40 00

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SECTION 22 63 00 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of natural gas systems work is indicated on drawings and schedules, and by requirements of this section.

B. Refer to Division-02 sections for trenching and backfill required in conjunction with gas service piping; not work of this section.

1.2 QUALITY ASSURANCE

A. Specimen Joints: Before commencing pipe laying, Contractor shall form specimen joints to demonstrate, to the satisfaction of the Owner, that materials and methods employed will result in watertight joints.

B. Qualification of Installers: The entire gasket system shall be installed by trained workmen skilled in the installation of such systems.

C. Codes and Standards:

1. ASME Compliance: Fabricate and install natural gas piping in accordance with ASME B31.2 "Fuel Gas Piping".

2. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA 54 "National Fuel Gas Code".

3. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company.

4. UMC Compliance: Fabricate and install natural gas systems in accordance with IAPMO "Uniform Mechanical Code".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for natural gas systems materials and products.

B. Maintenance Data: Submit maintenance data and parts lists for natural gas systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, pipes, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable and base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials use in natural gas systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Identification for Plumbing Piping and Equipment", in accordance with the following listing:

1. Building Distribution Piping: Plastic pipe markers.

2. Gas Valves: Plastic valve tags.

2.3 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems", in accordance with the following listing:

B. Gas Service Piping:

1. All Pipe Sizes: Black steel pipe; Schedule 40; wrought-steel buttwelding.

a. Wrapping: Machine wrap pipe using 50% overlap wrap, with polyvinyl chloride tape. Hand wrap fittings using 100% overlap wrap extending 6" (150 mm) beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions.

C. Building Distribution Piping:

1. Pipe Size 2" (50 mm) and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.

2. Pipe Size 2-1/2" (65 mm) and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-22 sections "Basic Plumbing Materials and Methods" and "Piping Specialties for Plumbing Systems", in accordance with the following listing:

1. Pipe escutcheons
2. Vandal-proof vent caps
3. Dielectric fittings
4. Pipe sleeves
5. Sleeve seals

2.5 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division-22 sections "Basic Plumbing Materials and Methods" and Hangers and Supports for Plumbing Piping and Equipment", in accordance with the following listing:

1. Adjustable swivel pipe rings for horizontal-piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.

2.6 SPECIAL VALVES

A. General: Special valves required for natural gas systems include the following types:

1. Gas Cocks:
    a. Gas Cocks 2" (50 mm) and Smaller: 150 psi (1020 kPa) non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
    b. Gas Cocks 2-1/2" (65 mm) and Larger: 125 psi (850 kPa) non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.
2. Control Valves:
    a. Master Gas Control Valve: Bronze body, packless, single seat, explosion-proof, solenoid operated, normally closed, UL approved, automatic reset, 120 volt.

2.7 PRESSURE REGULATING VALVES

A. General: Where required, provide single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2" (50 mm) and smaller, flanged ends for 2-1/2" (65 mm) and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

2.8 INCOMING NATURAL GAS/ GAS METER ASSEMBLY

A. General: Incoming gas service and gas meter assembly shall be provided by local utility company. Refer to drawings for location of meter assembly.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which natural gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Identification for Plumbing Piping and Equipment".

3.3 INSTALLATION OF NATURAL GAS PIPING

A. General: Install natural gas piping in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems"; and in accordance with applicable codes and local Utility Company requirements.

1. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

2. Remove cutting and threading burrs before assembling piping.

3. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

4. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

5. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

6. Install drip-legs in gas piping where indicated, and where required by regulation.

7. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

8. Use dielectric fittings where dissimilar metals are joined together.

9. Install piping with 1/64" per foot (1.3 mm per meter) (1/8%) downward slope in direction of flow.

10. Install piping parallel to other piping, but maintain minimum of 12" (300 mm) clearance between gas piping and steam or hydronic piping above 200°F (93°C).

11. For piping running through ducts or air plenums, install in welded conduit, ventilated on both ends.

12. For risers running through concrete or asphalt, install through minimum 6" (150 mm) pipe sleeve. Fill annular space with gravel.

13. Install magnesium anodes for underground steel pipe, one 5-lb (2.3 L) anode for up to 100' (30 m) in length and one 5-lb (2.3 L) anode for each additional 100' (30 m).

14. Install magnesium anodes for each underground steel or malleable iron fitting, isolated between two (2) sections of plastic pipe; one 3-lb (1.4 L) anode for each fitting.

3.4 GAS SERVICE

A. General: Arrange with Local Utility Company to provide gas service to indicated location with shutoff at terminus. Consult with Utility as to extent of its work, costs, fees and permits involved. Pay such costs and fees; obtain permits.

1. Extend service pipe from Utility's terminus to inside building wall, under Utility's direction.

2. Provide shutoff in gas service pipe at entry in building, extend pipe to gas meter location indicated; provide parts and accessories required by Utility to connect meter.

3.5 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Piping Specialties for Plumbing Systems".

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Install supports and anchors in accordance with Division-22 sections "Basic Plumbing Materials and Methods" and "Hangers and Supports for Plumbing Piping and Equipment".

3.7 INSTALLATION OF VALVES

A. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.

1. Locate gas cocks where easily accessible, and where they will be protected from possible injury.

B. Control Valves: Install as indicated. Refer to Division-26 for wiring; not work of this section.

C. Pressure Regulating Valves: Install as required to reduce pressure to meet the requirements of each piece of equipment. Valve shall comply with utility requirements. Pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream of each pressure regulating valve.

3.8 INSTALLATION OF GAS METER

A. Install gas meter in accordance with local utility company's installation instructions, and comply with requirements.

1. Set meter on concrete pad as indicated.

2. Hang meter on wall brackets as indicated.

3.9 EQUIPMENT CONNECTIONS

A. General: Connect gas piping to each gas-fired equipment item, with drip leg, shutoff gas cock and pressure regulating valve. Comply with equipment manufacturer's instructions.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

3.11 ADJUSTING AND CLEANING

A. Cleaning and Inspecting: Clean and inspect natural gas systems in accordance with requirements of Division-22 sections "Basic Plumbing Materials and Methods" and "Pipe, Tube and Fittings for Plumbing Systems".

3.12 SPARE PARTS

A. Valve Wrenches: Furnish to the Owner, with receipt, two (2) valve wrenches for each type of gas valve installed, requiring same.

END OF SECTION 22 63 00

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SECTION 23 01 00 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Unless otherwise modified, provisions of General Conditions, Supplementary Conditions and Division-01 govern work under the Mechanical Divisions.

B. Contract drawings for mechanical work are diagrammatic, intended to convey scope and general arrangement. Contractor shall review and coordinate routing of new work to clear existing piping, duct, electrical, structure, etc. at no cost to the Owner. All dimensions of existing conditions shall be considered approximate (for information only). All dimensions shall be verified prior to construction.

C. Contract Document Interpretation/Discrepancies:

1. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Architect/Engineer (A/E) of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the A/E.

2. In addition, should any contradiction, ambiguity, inconsistency, discrepancy or conflict appear in or between any of the Contract Documents, the Contractor, shall, before proceeding with the work in question, notify the A/E and request an interpretation. In no case shall he proceed with the affected work until advised by the A/E.

3. If the Contractor fails to make a request for interpretation of discrepancies or conflicts in the drawings or specifications, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the A/E. In all cases, the Contractor will be deemed to have estimated the most stringent materials and methods (i.e. the highest quality materials and most expensive manner of completing the work) unless he has requested and obtained written authorization as to which methods or materials will be required.

4. Each and every trade or subcontractor will be deemed to have familiarized himself with all drawings of this project, including Site/Civil, Architectural, Structural, Mechanical, Electrical, Plumbing, Fire Protection, Information Technology (IT), etc. so as to avoid coordination errors, omissions, and misinterpretations. No additional compensation will be authorized for alleged errors, omissions, and misinterpretation, whether they are a result of failure to observe these requirements or not.

D. The complete set of Architectural, Structural, Civil, Mechanical, Electrical, Plumbing, Fire Protection and IT drawings, specifications, and addenda apply to this work.

1.2 SCOPE

A. The work in Division-23 includes furnishing and installing the mechanical systems complete and ready for satisfactory service.

B. Requirements specified govern work in all sections of Division-23.

1.3 REFERENCES

A. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.

B. Refer to applicable contract drawings, specifications and addenda pertaining to other divisions for conditions affecting work.

C. Refer to Division-01 for description of alternates.

D. Refer to Division-01 for description of allowance items.

E. Refer to Division-01 for description of base bid items.

F. Refer to Division-01 for description of demolition items.

1.4 DEFINITIONS

A. Following are definitions of terms and expressions used in this Division:

1. "Approve" - to permit use of material, equipment or methods conditional upon compliance with contract document requirements.

2. "Concealed" - hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.

3. "Directed" - directed by Engineer.

4. "Ductwork" - includes ducts, fittings, housings, dampers, supports and accessories comprising a system.

5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.

6. "Exposed" - not concealed.

7. "Indicated" - indicated in Contract Documents.

8. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.

9. "Provide" - furnish and install.

10. "Removable" - detachable from the structure or system without physical alteration of materials or equipment or disturbance to other construction.

11. "Review" - limited observation or checking to ascertain general conformance with design concepts and general compliance with contract document requirements. Such action does not constitute a waiver or alteration of the contract requirements. Verification of quantities and dimensions shall be the responsibility of the Contractor.

12. “Appurtenances” - a device or assembly installed in the referenced system which performs some useful referenced function in the operation, maintenance, servicing, economy or safety of the system. Some examples include, but are not limited to aerators, anchors, supports, gauges, backflow preventers, expansion tanks, filters, flow controls, heat exchangers, interceptors, meters, pressure reducing valves, relief valves, dampers, separators and similar devices.

13. “Record Documents” - drawings, plans and specifications that indicate the nature and location of work reported by Contractors, but not verified by Consultant. Record documents cannot be considered reliable; as they are based on information reported by the Contractor only and is not verified by the Architect or Engineer (A/E).

1.5 RIGGING REQUIREMENTS

A. Prior to bidding, the Contractor shall verify that all equipment can be physically rigged to the proposed location without disturbance or dismantling of any existing or new physical obstacles. Should the rigging of any new equipment appear to be an issue, the Contractor shall inform the Architect or Engineer (A/E) seven (7) days prior to the bid date that the rigging of the new equipment may present a problem. Otherwise, the Contractor shall, in accordance with the manufacturer’s approval and without voiding warranties and/or certifications, have the equipment “broken down” into sections as required to install the equipment in its proposed location without disturbance or dismantling of any existing or new physical obstacles.

B. Failure to inform the Architect or Engineer (A/E) seven (7) days prior to the bid of any rigging problems will result in the Contractor accepting full responsibility for all modifications to the equipment or the physical obstacles required to install the equipment in its proposed location without additional cost to the Owner.

1.6 CONTRACTOR'S INSTALLATION DRAWINGS

A. Prior to fabrication and installation, submit shop drawings (min. scale - 1/4" = 1' - 0") illustrating all mechanical, electrical and plumbing (MEP) system elements (including but not limited to: ductwork, HVAC piping, plumbing piping, insulation, lighting fixtures, cable tray, conduit, expansion loops, supports, alignment guides, fire protection, etc.) coordinated with each other as well as the architectural and structural building elements. Installation drawings shall be based upon project specific, approved, product information for each of the MEP elements listed above (as well as architectural, structural, etc. systems), and shall be prepared at a minimum BIM LOD 400 (Building Information Modeling Level of Development 400) level of detail. Installation drawings shall be reviewed by Owner's representative prior to fabrication and installation of any new work and prior to the ordering of any mechanical equipment.

B. Should the Contractor not provide the coordinated installation drawings required above, the following shall apply:

1. The Contractor shall accept full and absolute responsibility for the coordination of all project materials and equipment to be installed as indicated on the contract documents.

2. Proposed change orders and/or time extensions will not be accepted for any additional work that results from coordination related changes.

3. A credit shall be issued to the Owner for the value of the coordinated installation drawings; the value of the credit to the Owner shall be as determined by the A/E.

C. Electronic files (AutoCad or Revit) of mechanical, electrical and plumbing (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request). The electronic files shall not be utilized for the preparation of coordination/installation/fabrication shop drawings. Coordination/installation/fabrication shop drawings shall be created independently from the electronic MEP files (i.e. AutoCad drawings and/or Revit model). Please note: the electronic MEP Revit model (where applicable) was created at a level of detail similar to BIM LOD 300; however, some MEP elements were modified to provide clarity and legibility to the two-dimensional construction documents. In addition, the electronic files may include delegated design elements that may differ as a result of the final delegated design to be completed by the Contractor (this may include all disciplines including architectural, structural, etc.). Modifications of the MEP systems to accommodate those delegated design elements shall be provided by the Contractor at no additional cost to the Owner.

1.7 MATERIAL, EQUIPMENT AND SUBSTITUTION REQUIREMENTS

A. Use products of one manufacturer where two or more items of same kind of equipment are required.

B. Materials and equipment shall have a record of two (2) years successful field use.

C. Where a specific manufacturer is listed on the drawings, that manufacturer shall be considered the basis of design for that particular item of equipment. Only the basis of design manufacturer has been verified to meet the project requirements (i.e. dimensions, weights, service clearances, electrical requirements, etc.).

D. Where the drawings and/or specifications indicate more than one manufacturer for a particular item of equipment, only those listed may submit products and services to be included in the work; manufacturers other than those listed will not be acceptable. Should the Contractor choose to use one of the specified manufacturers other than the basis of design, it shall be the responsibility of the Contractor to verify that the equipment meets all project requirements including, but not limited to, verification of all dimensions, weights, service clearances, electrical requirements, etc. All changes incurred shall be the responsibility of the Contractor and shall be provided at no additional cost to the Owner.

E. Substitutions must be submitted for consideration seven (7) days prior to the original bid date. Consideration of substitutions shall be at the sole discretion of the Engineer. Substitution submittals shall include all information required in the "Submittals" paragraph

of this specification section, as well as all other requirements indicated through the Division-23 specifications. Substitutions will not mitigate, in any way, the Contractor's responsibility in complying with the coordination, contract requirements or design intent. Any additional electrical, structural or special requirements, etc. shall be the responsibility of the Contractor. Also, any additional cost incurred as a result of substitution shall be the responsibility of the Contractor.

F. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.8 MATERIAL AND EQUIPMENT LIST

A. Within thirty (30) days after award of the contract, submit for Engineer's review a list of subcontractors' and manufacturers' names for items proposed for this project.

1.9 SUBMITTALS

A. Where the drawings and/or specifications indicate more than one allowable manufacturer for a particular piece of equipment and/or product, only those manufacturers indicated may submit products and services to be included in the work. Unless otherwise indicated, manufacturers other than those listed will not be acceptable.

B. Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

C. Shop Drawings: Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment. Include equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted. All equipment and/or products shall be submitted by an authorized factory representative of that particular product.

D. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineer for review. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing

will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for review. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

F. Contractor shall thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission and coordinate installation requirements for equipment submitted, including, a) the verification of equipment weights relative to the existing and/or new structural support system and b) the verification of equipment dimensions relative to existing and/or new architectural conditions. Contractor shall be responsible for correctness of all submittals.

G. Submittals will be checked only for general conformance with the design concept and are subject to the original contract documents, as well as any corrections and comments noted. Comments noted, if any, will not be considered a complete list of all omissions, deviations and corrections necessary to meet the requirements of the contract documents. The Contractor will be responsible to confirm that the final product and installation will be in conformance with the contract documents in their entirety, including the responsibility to fully coordinate all work with other trades and to confirm the correctness of dimensions, quantities, and capacities. Submittal review does not authorize or constitute a change to the contract requirements and does not release the Contractor of responsibility to conform to the contract requirements. Requirements of the contract are not waived by review of any and all substitutions. The Contractor must fulfill the terms of the contract.

H. Compliance Review Form: Each equipment submittal must include a Compliance Review Form formatted as follows:

1. Section 1: Certify that the submittal is in complete compliance with the plans and specifications, except for the numbered and footnoted deviations and exceptions as defined herein. Deviations or exceptions taken in a cover letter or by contradiction or omission shall not constitute a release from the requirement that the equipment be in complete compliance with the plans and specifications.

2. Section 2: Provide a detailed paragraph by paragraph annotation of the specification with an individual “C”, “D”, or “E” noted in the margin, as follows:

    a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.

    b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

    c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

I. Electronic Submittals: Should the Contractor elect to submit electronic shop drawings/submittals, the procedure shall be as follows:

1. Provide a transmittal with the electronic shop drawing/submittal indicating that the document was transmitted electronically. Transmittal shall also include verification of the Contractor's review indicating compliance with the contract documents in accordance with paragraph 1.09.F of this section.

2. Sequentially number all pages on the electronic shop drawing/submittal. The total number of pages shall be reflected in the transmittal.

3. Submittal review comments shall be transmitted electronically. Large documents will be scanned with comments as necessary and returned electronically.

4. All shop drawings such as, but not limited to: coordination drawings, ductwork shop drawings, fire alarm drawings, ductbank layouts, etc. shall be submitted in hard copy, full size format.

5. Provide hard copy of the shop drawing/submittal for each of the Operations and Maintenance Manuals.

6. Failure to comply with the above will result in the submittal being returned and marked "Not Reviewed".

J. Submittals will be reviewed for general compliance with design concept in accordance with contract documents. Dimensions, quantities, weights, or other details will not be verified by the A/E; this is the responsibility of the Contractor.

K. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.

L. Review Period: BKM shall be allotted two (2) weeks for the processing, review and return of all submittals. It shall be incumbent upon the Contractor to include this time period in their schedule.

1. Resubmittals: BKM shall be allotted an additional two weeks (14 days) for the review of each resubmittal. Again, it shall be the Contractor's responsibility to submit the appropriate materials in a timely fashion.

2. Contract Extension: No extension in contract time will be authorized as a result of the timeline addressed above.

M. Submittal Identifications:

1. Place a permanent label or title block on each submittal for identification.

2. Indicate name of firm or entity that prepared each submittal on label or title block.

3. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by A/E.

4. Include the following information on label for processing and recording action taken:

a. Project name

b. Date

c. Name and address of A/E

d. Name and address of Contractor

e. Name and address of subcontractor

f. Name and address of supplier

g. Name of manufacturer

h. Unique identifier, including revision number

i. Number and title of appropriate specification section

j. Drawing number and detail references, as appropriate

k. Other necessary identification

l. Example: 230700-01-0

1) 230700 references the spec section

2) 01 indicates this is the first submittal from this spec section

3) 0 indicates this is the original submittal (where 1 would indicate this is the first re-submittal)

N. The Engineer will provide a maximum of two (2) submittal reviews per equipment submittal; the initial review plus one (1) re-submittal. Should the re-submittal be returned “Not Acceptable” or “Revise and Resubmit”, the Contractor shall choose one of the following courses of action:

1. Provide the exact manufacturer and model indicated in the contract documents as the basis of design, or

2. Reimburse the Engineer for all additional review time required to achieve a submittal review from the Engineer of “No Exceptions Taken.”

3. Should the Contractor choose option 2 above, the Engineer shall be reimbursed at an hourly rate of $175 per hour with payment due prior to the return of the final submittal. In addition, the Contractor shall accept complete responsibility for all delays resulting from the submittal review process extending beyond two (2) reviews per equipment submittal.

O. Resubmittals: Resubmittals shall comply with paragraph 1.09 of this section and the following additional requirements.

1. Resubmittals shall include a written response to each submittal comment. Provide a detailed comment by comment annotation of the submittal review comments with an individual “C”, “D”, or “E” as follows:

    a. “C” shall mean compliance with no exceptions. Provide a numbered footnote (i.e. C1, C2, C3, etc.) for each comment or clarification.

    b. “D” shall mean compliance with deviations. For each deviation, provide a numbered footnote (i.e. D1, D2, D3, etc.) with a detailed explanation of how the intent of this specification is to be satisfied.

    c. “E” shall mean exception. The equipment offered is not in compliance with the specifications. For each exception, provide a numbered footnote (i.e. E1, E2, E3, etc.) with a detailed description of the exception.

1.10 MANUFACTURER'S RECOMMENDATIONS

A. Installation procedures are required to be in accordance with the recommendations of the manufacturer of the material being installed.

1.11 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

1.12 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.13 WORKMANSHIP

A. Remove and replace, at no extra cost, all work not orderly, reasonably neat, or workmanlike.

B. Coordinate all work and cooperate with other trades to facilitate execution of work.

1.14 SITE EXAMINATION/EXISTING CONDITIONS VERIFICATION

A. Failure to visit site and become familiar with existing conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract documents.

B. Contractor shall field verify existing services and direction of flow of piping and ductwork prior to connection. Existing mechanical identification shall not constitute proper verification of service or direction of flow.

1.15 REGULATIONS AND PERMITS

A. Comply with all applicable codes and regulations.

B. All equipment provided shall be in accordance with all applicable local, state, and federal codes, guidelines and standards, as well as the authority having jurisdiction. Equipment and installation shall be in compliance with all applicable energy codes including the most current version of ASHRAE Standard 90.1.

C. Obtain and pay for all required permits.

1.16 CUTTING AND PATCHING

A. Unless otherwise directed, do all cutting and patching. Damaged work, including fireproofing and waterproofing shall be repaired by skilled mechanics of the trade involved.

B. Do not cut walls, floors, roofs, reinforced concrete or structural steel without structural Engineer's permission. Install services without affecting reinforcing steel.

C. In precast concrete plank drill all holes with a Carboloy tipped drill. Follow instructions of structural Engineer. Cut no reinforcing bars.

1.17 LINTELS

A. Under this Section provide all lintels not provided elsewhere which are required for openings for the installations of mechanical work. Lintels shall meet the requirements of the structural sections.

1.18 CLEANING UP

A. Keep premises free from accumulation of debris.

B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.

C. On discontinuance of part of the work, place all debris in containers and promptly remove them from the Owner's property.

D. Leave all areas broom clean.

E. Final clean-up shall be performed.

1.19 AREAS REQUIRING SPECIAL FINISHES/PAINTING

A. In kitchens, cafeterias, dining rooms, serving pantries and utility rooms [polish chromium or nickel plate] all exposed and uninsulated piping including valves, traps, strainers and appurtenant items; and exposed electrical work including conduit, boxes, switches starters and disconnects. Finish shall not be applied to nameplates, pushbuttons. Stainless steel housing and plates require no plating or paints.

B. Provide surface preparation, priming and painting of all mechanical and boiler room floors to provide a smooth, cleanable surface. Primer and paint shall be appropriate for concrete slab surfaces. Where painting over existing surfaces, coatings, or where the floor is soiled, degrease and follow manufacturer's recommendations for surface preparation, priming and painting. See specification sections "Painting" and “HVAC Related Work”, where applicable, for additional painting requirements. Color shall be selected by the A/E.

1.20 PROTECTION

A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises.

B. Cap or plug openings in equipment, piping, duct, and conduit systems to exclude dirt and other foreign material. Rags, wool, cotton, paper, waste or similar materials shall not be used for plugging.

C. Unless approved by Owner, HVAC equipment shall not be used for temporary heating or ventilation during construction.

D. Contractor shall protect all existing mechanical, electrical and architectural equipment, materials, finishes, etc. located within or adjacent to the work environment. Contractor shall be responsible for restoration of all existing mechanical, electrical and architectural items to remain. All equipment to remain must be restored to its pre-existing condition prior to the start of work. Restoration and/or replacement shall be at no cost to the Owner.

E. Contractor shall provide temporary cooling and heating as required to protect all construction materials from the potential adverse effects of high or low temperature and humidity. Upon delivery of ceiling and other finish materials to a location within the building, environmental conditions in all spaces where the materials will be either stored or installed shall be permanently maintained at 75°F (+2°F) and 50% RH (+5%). Should the HVAC include a reheat system, the reheat system shall be energized to provide temperature and humidity control whenever the HVAC system is energized. Contractor shall pay for all utility, fuel, operational, maintenance and repair costs associated with providing the environmental conditions indicated above until the Owner accepts occupancy of the building.

1.21 CLEANING OF SYSTEMS

A. After satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers and other accessory items, thoroughly clean all systems. Blow out and flush piping until interiors are free of foreign matter.

B. Flush piping in recirculating water systems to remove all cutting oil, excess pipe joint compound and other foreign materials. Furnish necessary temporary pumping equipment

to thoroughly clean the water piping. Do not use any system pump until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. After completion, submit a certificate of completion to Engineer stating name of the service company used.

C. Leave strainers and dirt pockets in clean condition.

D. Clean fans, ductwork, enclosures, flues, registers, grilles and diffusers at completion of work. Vacuum or swab clean low pressure ducts and outlets supplying operating rooms, delivery rooms, nurseries.

E. Permanent air systems operated for temporary heating during construction shall only be operated with filters installed of equal efficiency to those specified. Prior to acceptance and after cleaning of system, replace with clean filters as specified. Return air openings shall be equipped with filter cloth to protect against debris entering the ductwork.

1. If upon periodic inspection, it is determined that the permanent ductwork has become contaminated with construction debris, then the Contractor shall be required to procure the services of a professional duct cleaning agency prior to substantial completion, at no additional cost to the Owner.

F. Should any system become clogged with construction refuse after acceptance, the Contractor shall pay for all labor and materials required to locate and remove the obstruction and replace and repair work disturbed.

G. Leave all systems clean, and in complete running order.

H. Equipment that has been subjected to the elements shall be cleaned of all rust, dirt and debris and repainted to match original finish.

1.22 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be

repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler, air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

1.23 OPERATING AND MAINTENANCE MANUAL

A. Submit Operation and Maintenance Manuals as follows:

1. Provide an electronic version for review by the Owner and A/E, including bookmarks of all section and subsections.

2. After acceptance of the electronic copy, produce hard copies in three-ring binders with each section separated by tab divider. Include protective plastic sleeves for any software or folded large documents submitted. Provide a minimum of two (2) copies to the Owner.

B. At a minimum, the manual shall contain the following:

1. Title page

2. Table of contents

3. Contractor and sub-contractor contact information

4. Supplier contact information for all mechanical equipment

5. Copies of manufacturer’s and Contractor’s warranty information (project and equipment) for all mechanical equipment.

6. Submittal log for all mechanical equipment

7. One (1) reviewed copy of each shop drawing or submittal incorporating all A/E and Owner submittal review comments.

8. Copy of inspector acceptance certificates / documents.

9. Provide an 11 x 17 fold-out drawing of each floor plan and indicate locations of the following:

    a. System shutoff valves

    b. Fire/smoke dampers

10. All duct, pipe and equipment pressure test reports complete with 11 x 17 fold-out drawing, indicating all systems tested.

11. Final Test and Balance (TAB) Reports. Do not include reports that have not been accepted by the A/E. Pencil or partial copies will not be acceptable.

12. Maintenance procedures for each item of mechanical equipment to include frequency and type of maintenance, spare parts and attic/stock list. This shall include the manufacturer’s literature indicating operating and maintenance instructions, parts list, illustrations and diagrams.

13. An itemized list of all spare parts and specialty tools shall be transmitted to the Owner.

14. A report of the training procedures and content provided as well as the attendance log.

15. Valve tag chart

16. Mechanical systems functional performance verification forms, calibration reports and compliance statement indicating that all systems are installed and functioning per the contract requirements.

1.24 TOOLS AND LUBRICANTS

A. Furnish and turn over to the Owner, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.

D. Lubricants: A minimum of one quart (.9 L) of oil, and one pound (450 g) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

1.25 FIELD INSTRUCTION

A. Upon completion of work, instruct Owner's representative in the proper operation and maintenance of the mechanical and electrical systems.

B. Instruction periods specified below shall be in addition to instruction specified for certain items elsewhere in the specifications.

C. Instructions shall be given by persons expert in the following systems and equipment and shall include descriptions and demonstration of procedures, data logging, and analysis.

1. Cooling Plant - Including refrigeration plant, cooling tower, pumps, related equipment, water treatment, safety controls. Provide 8 hours of instruction.

2. Air Systems - Including air handling units, heating and cooling coils, filters, fans, safety controls and other air handling equipment. Provide 8 hours of instruction.

3. Automatic Control - Including operating controls for all heating, cooling, ventilating systems, control centers, panels, compressed air system. Provide 8 hours of instruction.

4. General Instructions - Including review of written operating instructions and balancing report, miscellaneous instructions. Provide 8 hours of instruction.

D. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than 5 eight hour days.

E. Prepare statement(s) for signing by Owner's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to Engineer.

F. Final mechanical demonstration of all mechanical equipment shall be recorded in DVD compatible format. Provide DVDs to the Owner.

1.26 RECORD DOCUMENTS

A. The Contractor shall maintain a record set of mechanical prints at the project site and shall indicate thereon any changes made to the contract drawings, including, but not limited to addenda, field sketches, RFI responses, supplemental drawings, sketches, etc. Where changes are made that are reflective of supplemental instructions, revisions, RFI responses, etc., the Contractor shall make clear references to those changes.

B. A separate set of neat, legible mechanical contract prints shall be kept at the project site at all times during the construction of the work for the express purpose of showing any and all changes indicated in paragraph A. above. The prints shall be marked up daily showing all changes to the original documents. The prints shall be marked up in a neat, legible manner using a red pen. Periodic review of the Record Documents will be conducted by the Owner’s Representative or A/E. Should this review indicate that the Record Documents are deficient or not up to date, the Contractor shall immediately bring the documents into compliance and make the corrections.

C. Upon completion of the project and before final close-out, the Contractor shall be responsible for producing a final set of record documents in the same electronic format as the construction documents (i.e. AutoCad or Revit). One (1) set of full size prints, one (1) CD of the electronic files, along with the red-lined marked up field set shall be delivered to the Owner upon completion. If requested, the electronic files shall be uploaded to the Owner’s FTP site. The final documents shall indicate in the title or revision block “RECORD DOCUMENTS” along with the date completed. The electronic format shall be compatible with the Owner’s preferred version of AutoCad or Revit. Coordinate

with the Owner before producing the CD or uploading to the FTP site. Not acceptable are Contractor installation drawings, shop drawings or multi-layers of work on a single drawing. The final as-built product shall mirror the contract bid documents using the project page layout, format and project title block.

D. Electronic files (AutoCad or Revit) of mechanical, electrical, plumbing and fire protection (MEP) drawings may be made available upon receipt of a signed copy of the Engineer's Electronic Document Disclaimer (available upon request).

E. Should the Contractor's electronic Record Documents not be considered complete, they will be returned for completion and/or correction.

1.27 DEMOLITION

A. All demolition of existing mechanical and electrical piping, auxiliaries and equipment, shall be as specified under the Architectural "Demolition" section, of these specifications, as shown on the drawings, and as required to complete the new and renovated installations and shall be performed by the respective mechanical and electrical contractors.

B. This work shall include the disconnection and capping of existing services, relocation of certain equipment, and the removal of existing piping, wiring, fittings, equipment, including heat transfer units, air handling units, fans, electrical controls and panelboxes, ductwork, etc., not reused in the new work or required to complete the renovation work. Contractor shall note the drawings specify certain existing equipment to be reused.

C. Where supports and piping are removed, holes remaining in floors, walls and ceilings must be patched and refinished to match the adjoining original surfaces and finishes.

D. Any removed items requested by the Owner shall remain the property of the Owner. Contractor shall remove equipment and store on site as directed by the Owner. All other equipment or material shall become the property of the Contractor and shall be removed from the site. Contractor shall meet Federal EPA Laws, Regulations and Guidelines in regard to removal of asbestos insulation.

E. The Contractor shall use care when performing selective building and site demolition. The Contractor shall be responsible for damage inclusive of but not limited to: building finishes, lighting (interior and exterior), furniture, structure, site, utilities (above and below ground), mechanical, plumbing, telecommunications and electrical equipment / systems. Should any damage occur or should any remedial work be required, the Contractor shall be responsible to repair and or replace the damaged item(s) to the Owner's satisfaction at no additional cost. The Contractor shall be responsible for surveying (including contacting Miss Utility), photo documenting and restoring the surrounding work site(s) to the original pre-demolition condition and / or to the Owner's satisfaction upon completion of the work at no additional cost.

1.28 OUTAGES

A. All mechanical outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the Contractor and the Owner's Representative.

B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten (10) days in advance with the Owner's Representative. All such outages shall be performed during other than normal duty hours.

C. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and the convenience of the using agency.

1.29 LEED CERTIFICATION

A. This project is required to obtain a LEED certification. The Contractor shall provide all required LEED documentation as required to achieve the construction related LEED credits.

B. The project includes both LEED Fundamental and Enhanced Commissioning. Provide all services as required for compliance with the Fundamental and Enhanced Commissioning requirements. Coordinate with the Commissioning Agent as required. Refer to the Commissioning specification sections for additional information.

1.30 GUARANTEE/WARRANTY

A. Each Contractor shall furnish a guarantee covering all labor and materials furnished by him for a period of two (2) years from the date of final acceptance of his work, and he shall agree to repair and make good at his own expense any and all defects which may appear in his work during that time if, in the judgment of the Engineer, such defects arise from defective workmanship and/or imperfect or inferior material.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.

C. Within the two (2) year warranty/guarantee period, manufacturer's recommended maintenance shall be provided by the Contractor.

D. In addition to the warranties indicated above, provide a five (5) year parts and labor warranty for each of the following:

1. Chillers

2. All air conditioning unit related compressors (i.e. rooftop DX units, all air cooled condensing units for VRV systems, split system units, etc.).

1.31 UTILITY REBATE

A. Utility Rebate Application: The mechanical contractor shall provide and submit a utility rebate application to the local utility (BGE Smart Energy Program, or other local utility serving this project area) for the major HVAC equipment (such as chillers, packaged A/C units, variable refrigerant flow systems, etc.). The rebate application shall include all information required by the utility company program administrator (ICF International, or other rebate administrator) including, but not limited to, the application, supporting

calculations, analysis, comparison of the proposed equipment to baseline equipment or system., etc.; all as defined and/or required by the program administrator. The Owner shall be indicated on the application as the recipient for the full rebate.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION 23 01 00

SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this Section.

B. Requirements specified in Division-23 Section "Basic HVAC Requirements" apply to this Section.

1.2 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.

2. Firestopping: Provide seals for all openings (new and existing) through fire-rated walls, floors, or ceilings used as passage for mechanical and electrical components such as piping, ductwork, conduit, etc.

3. Selective demolition including:

   a. Nondestructive removal of materials and equipment for reuse or salvage as indicated.

   b. Dismantling mechanical materials and equipment made obsolete by these installations.

4. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment up to five (5) feet (1500 mm) outside the building.

5. Miscellaneous metals for support of mechanical materials and equipment.

6. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.

7. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

8. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.

3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

B. The following definitions apply to firestopping:

1. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

2. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

3. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gases and smoke.

4. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

5. Construction Gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.

6. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

7. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division-01 Specification Sections.

B. Product data for the following products:

1. Access panels and doors

2. Joint sealers

C. Firestopping: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.

1. Provide details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.

2. Provide drawings relating to non-standard applications as needed.

D. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations in accordance with Division-23 sections.

F. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

G. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

H. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Owner occupancy specified in Division-01 Section "Summary of Work."

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer for the installation and application of joint sealers, access panels and doors, and firestopping materials with at least two years' experience with installations.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

D. Local and State Regulatory Requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL firestop system numbers, or UL classified devices.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition: The following project conditions apply:

1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

1.8 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.

B. Notify the Architect at least five (5) days prior to commencing demolition operations.

C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 FIRESTOPPING

A. All penetrations through fire barriers (new and existing) shall be firestopped with an approved material that is capable of maintaining the fire resistance rating of the barrier.

All firestop sealants shall conform to ASTM E 814, ASTM E 119, UL 1479, UL 2079 CAN/ULC S115, and CAN/ULC S101.

B. Firestop material shall be latex based, intumescent caulk intended for use for all thru-penetrations with piping, ducts, cable trays, conduit, and cables.

C. When exposed to high temperatures or fires, the caulk shall expand in volume to quickly close off voids left by melting or burning construction materials. Caulk shall be applied by a standard caulk gun and remain flexible after curing.

D. Acceptable products shall be limited to Johns Manville “Firetemp-C1;” Hilti “FS-One;” or 3M “CP25WB+.” Coordinate with General Contractor such that a single manufacturer/ product is utilized throughout the project for all fire and smoke stopping materials.

2.3 SMOKE STOPPING

A. All penetrations through smoke barriers, smoke partitions, or any other surface required to resist the passage of smoke (new and existing) shall be provided with a smoke stop sealant and/or system that has been independently tested to provide an acceptable smoke seal that will resist the passage of smoke. Smoke stop systems (including product and installation) shall conform to all applicable standards (including but not limited to ASTM, UL and NFPA), as well as all other local, state or federal requirements.

B. Acceptable manufacturers shall be limited to the manufacturers that may provide firestopping materials/systems (see paragraph 2.02 of this section). Coordinate with the General Contractor such that a single manufacturer/product is utilized throughout the project for all fire and smoke stopping materials.

2.4 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.5 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches (12 mm).

2.6 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.

2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

2.7 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage (1.6 mm) steel, with a 1-inch (25 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1-inch (25 mm) wide exposed perimeter flange and adjustable metal masonry anchors.

2. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.

3. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage (2 mm) sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees (3.05 Radians); factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks. [Common use]

E. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide two (2) keys. [Secured areas only: note as such].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOP INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal new and existing holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than four inches (100 mm) in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

D. Protect materials from damage on surface subject to traffic.

E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.

F. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.

G. Install smoke stopping as specified for firestopping (new and existing).

H. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12 inch (300 mm) wide fiber dams for full thickness and height of air cavity at maximum 15 foot (4500 mm) intervals.

3.3 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.4 SELECTIVE DEMOLITION

A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.

B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.

C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

D. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

1. Inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.

2. Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping and ducts that are allowed to remain.

3. Perform cutting and patching required for demolition in accordance with Division-1 Section "Cutting and Patching."

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

2. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.8 INSTALLATION OF ACCESS DOORS

A. Provide access doors (minimum 18" x 18") as required to provide maintainable access to all mechanical equipment including, but not limited to, valves, dampers, air terminals, etc.

B. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

END OF SECTION 23 05 00

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SECTION 23 05 13 - ELECTRICAL PROVISIONS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of electrical provisions to be provided as mechanical work is indicated in all other Division-23 sections, on drawings, and as further specified in this section.

B. Types of work normally recognized as electrical, but provided as mechanical, specified or partially specified in this section, include but are not necessarily limited to the following:

1. Motors for mechanical equipment.

2. Motor starters and Variable Frequency Drives (VFDs) for mechanical equipment.

3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.

4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.

5. Electrical heating coils and similar elements in mechanical equipment.

C. Refer to requirements of Division-26 sections.

1.2 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division-26 sections for electrical work of this section which is not otherwise specified.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.3 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing (Basic Mechanical and Division-1 requirements), submit separate listing showing rating, power characteristics, application (connected equipment), and general location of every motor to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.

1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.

B. Coordination with Electrical Submittals: Where a Power System Study is provided under Division 26, coordinate with the general contractor and electrical contractor as required to submit the Power System Study submittal prior to the chiller submittal. Short circuit current information is required in order to complete the review of the chiller submittal. If chiller is procured prior to receipt of the power system study, all chiller modifications shall be provided as required at no cost to owner.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Characteristics: Except where more stringent requirements are indicated, and except where required item of mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work:

B. Temperature Rating: Rated for 113 degrees F (40 degrees C) environment with maximum 122 degrees F (50 degrees C) temperature rise for continuous duty at full-load (Class B Insulation).

C. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than five (5) starts per hour for manually controlled motors.

D. Phases and Current Characteristics: Provide squirrel cage induction polyphase motors for 1/2 hp (.4 kW) and larger, and provide capacitor-start single-phase motors for 1/3 hp (.25 kW) and smaller, except 1/6 hp (.1 kW) and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-23 requirements. For 2-speed motors provide two (2) separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

E. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

F. Motor Construction: Provide general purpose, continuous duty motors, Class F insulation, Design "B" except "C" where required for high starting torque.

1. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division-23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.

2. Enclosure Type: Except as otherwise indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division-23 for other enclosure requirements.

3. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.

4. Noise Rating: Provide industry standard "Quiet" rating on motors.

5. Efficiency: For motors 1 horsepower (.7 kW) or higher, provide motors with minimum efficiencies as follows in accordance with IEEE Standard 112, Test Method B:

   a. Open Motors (ODP)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	1200 RPM	1800 RPM	3600 RPM
1 (.7)	82.5%	85.5%	77.0%
1.5 (1.1)	86.5%	86.5%	84.0%
2 (1.5)	87.5%	86.5%	85.5%
3 (2.2)	88.5%	89.5%	85.5%
5 (4)	89.5%	89.5%	86.5%
7.5 (5.6)	90.2%	91.0%	88.5%
10 (8)	91.7%	91.7%	89.5%

   * Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

   b. Enclosed Motors (TEFC)

MOTOR HP (KW)	MINIMUM EFFICIENCY *		
	1200 RPM	1800 RPM	3600 RPM
1 (.7)	82.5%	85.5%	77.0%
1.5 (1.1)	87.5%	86.5%	84.0%
2 (1.5)	88.5%	86.5%	85.5%
3 (2.2)	89.5%	89.5%	86.5%
5 (4)	89.5%	89.5%	88.5%
7.5 (5.6)	91.0%	91.7%	89.5%
10 (8)	91.0%	91.7%	90.2%

* Required Full Load Nominal Efficiency shall be in accordance with EISA 2007. Where efficiency listed above is higher than the EISA 2007 requirement, provide the higher efficiency indicated.

c. Where fan or pump motors are used in conjunction with, or controlled by, a variable frequency drive (VFD), motors shall be suitable for VFD operation (inverter duty motors).

d. For motors less than 1 horsepower (.7 kW), provide motors with higher efficiency than "average standard industry motors," in accordance with IEEE Standard 112, test method B.

G. Nameplate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special feature and similar information.

H. Motor Modifications: In cases where the equipment submitted requires additional motors and/or controls, circuiting and related equipment shall be provided as approved and in accordance with the National Electrical Code. All costs relative to these electrical changes shall be included under the Section in which the equipment is furnished and installed and shall be coordinated with the electrical work at no expense to the Owner.

I. Power Factor: All motors one (1) horsepower and above shall have a minimum power factor of 0.90.

J. All motors operated on variable frequency drives shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two (2) rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one (1) shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

2.2 MOTOR STARTERS AND VARIABLE FREQUENCY DRIVES (VFDS)

A. Where motor starters and/or variable frequency drives (VFDs) are indicated for mechanical equipment, they shall comply with all requirements outlined with the electrical specifications for motor starters and VFDs. Where motor starters and/or VFDs are provided by the mechanical contractor, or as a portion of a packaged mechanical unit, the electrical specifications shall also apply. All VFDs for the project, whether provided by the mechanical or electrical contractor, shall be provided by a single manufacturer, and shall include the same features and options.

2.3 MECHANICAL EQUIPMENT

A. Electrical Heating Elements: Where electrical resistance coils and other heating elements are included in mechanical equipment or otherwise indicated as mechanical work, and except as otherwise indicated, provide 120-volt units where rating is less than 2 kW, higher-voltage single phase units where rating is 2 kW but less than 5 kW, and higher-voltage 3-phase units where rating is 5 kW and greater.

B. All packaged roof top units and/or DOAS units electrical components shall have an overall short circuit withstanding rating of at least 65,000 Ampere Interrupting Capacity and be UL listed as such.

C. All mechanical equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp (.25 kW) and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory installed on equipment unit to electrical Installer for installation.

C. Install furnished under Division-26 starter panels and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate in accordance with National Electric Code for installation requirements.

END OF SECTION 23 05 13

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SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of hangers and supports specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Building Attachments
5. Saddles and Shields
6. Spring Hangers and Supports
7. Miscellaneous Materials
8. Roof Equipment Supports
9. Anchors
10. Equipment Supports

C. Hangers and supports furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of hangers and supports, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
2. NFPA, UL, and FM Compliance: Provide products which comply with NFPA 13 listed and labeled by UL and FM where used for fire protection piping systems.
3. MSS Standard Compliance:

a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

b. Select and apply pipe hangers and supports, complying with MSS SP-69.

c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.

d. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, selected by Installer to suit horizontal-piping systems in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.2 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.3 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.4 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. Provide copper-plated hangers and supports for copper-piping systems. To avoid future electrolysis or corrosion, copper plated hangers, supports, clamps, rod attachments, and building attachments shall not be in direct contact with copper piping. A separation material shall be installed between the pipe and the copper plated hanger, support, clamp, etc. The separation material shall prohibit electrical conductance and prevent galvanic action or corrosion between dissimilar metals. Separation material shall be guaranteed for a minimum of thirty (30) years.

2.5 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2).

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which hangers and supports are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

A. Install attachments at required locations within concrete or steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi (17240 kPa) is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on chilled water piping, install coated protective shields.

3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

4. For all insulated piping 2-1/2” (63 mm) and larger, provide insulated saddles as follows:

a. For chilled water and condenser water, as well as heating water and low pressure steam (up to 250ºF), provide the following:

1) Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.

2) For cold applications below 75ºF (24ºC) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.

3) The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.

4) Provide visible inspection sticker at the bottom of each saddle.

5) Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

b. For medium and high pressure steam operating above 250ºF, provide the following:

1) Non-compressive, rigid calcium silicate insulation. Fire and smoke rating shall be 25/50 or below per ASTM E84.

2) The calcium silicate insulation shall have a compression rating of 100 psi or higher and thermal conductivity K factor of 0.50 at a mean temperature of 300ºF per ASTM Standard C533.

3) The insulation shall be protected with an abuse resistant vapor/moisture barrier. Seal the longitudinal and butt joints with matching tape.

4) Secure the insulated saddle with metal banding on both sides. Provide visible inspection sticker at the bottom of each saddle.

5) Pipe insulation saddles shall be Tru-Balance 1200E as manufactured by Buckaroos, Inc. or equivalent.

I. Spacing: Hanger spacing for piping shall not exceed 8 feet (2400 mm) on centers for pipe 1-1/4" (32 mm) or smaller, and 10 feet (3 m) for pipe 1-1/2" (40 mm) and larger. Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

3.4 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.5 EQUIPMENT SUPPORTS

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division-23. Size bases to extend minimum of 4" (100 mm) beyond equipment base in any direction; and 4" (100 mm) above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.6 PAINTING

A. All hangers, supports, clamps and assemblies shall be primed and painted with rust inhibitors.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION ISOLATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of vibration isolation work to be provided under this Contract is covered by the requirements of this Section, all other Division-23 sections and the Contract Drawings including structural, architectural, mechanical and electrical which identify equipment and systems requiring vibration isolation treatment.

B. Types: Types of vibration isolation equipment and systems specified in this Section include:

TYPE	DESCRIPTION
1 Isolator	Ribbed Neoprene Pads
2I Isolator	Neoprene-In-Shear Type
2H Hanger	Rubber-In-Shear Type
3I Isolator	Open Spring Type
3H Hanger	Combination Spring and Neoprene Type
4 Isolator	Vertically Restrained Spring Isolators
5 Thrust	Restraints Spring Type Installed in Pairs

C. Selection of Isolators: Provide isolators selected by a vibration isolator equipment specialist.

1. Conform to isolator types herein specified.

2. Examine the contract drawings for sizes, horsepowers, rotational speeds, equipment location, length of span between columns and beams and construction type to determine the isolator selection type and deflection required for each piece of mechanical equipment.

3. Conform to the requirements of the most current edition of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, "HVAC Applications", Sound and Vibration Control.

1.2 QUALITY ASSURANCE

A. Codes: At a minimum, conform to the most current edition of ASHRAE Handbook, "HVAC Applications".

B. Manufacturer: Isolators of the same type shall be the product of the same manufacturer. The manufacturer shall publish and maintain a full line of materials, engineering and application data and operating and maintenance instructions.

1.3 SUBMITTALS

A. Contractor's Certification: Vibration isolator submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis against each piece of mechanical equipment, shown or specified in the Contract Documents, which requires vibration isolation.

B. Manufacturer's Certification: The manufacturer or manufacturers (if there are more than one) shall each certify that the selections of vibration isolation equipment are based upon the drawings and specifications, and that each piece of mechanical equipment has been examined for rotational speed, equipment type, mounting location, and supporting span between column centers, and that an appropriate isolator has been selected.

C. Product Data: Furnish manufacturer's product data covering each isolator type for style, characteristic, and finish.

1. Isolator quantities, dimensions, deflections, capacities and types shall remain the responsibility of the manufacturer and the Contractor.

D. Shop Drawings: Where coordinated shop drawings are required, provide layout drawings, drawn to a scale of not less than 1/4-inch to 1-foot (6 mm to 300 mm), showing the proposed layout of equipment and piping systems and the location and type of each vibration isolation device.

1. Carefully examine other sections requiring coordinated shop drawings and prepare isolation shop drawings to the same scale showing the location of each vibration isolation equipment base, pipe hanger, flexible connection, and isolator.

1.4 STORAGE AND PROTECTION

A. Storage: Store vibration isolation equipment indoors in the manufacturer's original shipping containers. Preclude the entrance of construction dirt and debris.

1. Vibration isolation equipment and bases, which show signs of rust, cement or concrete fouling, dirt and construction debris shall be disassembled and cleaned, approved or removed from the project site and replaced with new.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Mason

2. Vibration Eliminator Co.

3. Kinetics Noise Control

2.2 EQUIPMENT

A. Dimensions: The schedule shows dimensions for deflection and sizes all in inches.

B. Spans: Where referenced, the schedule shows spans of the longest bay dimension for slabs or beams supported between columns. Dimensions are in feet.

C. Selection: Exact mounting sizes, dimensions and quantity of isolators and static deflection required shall be determined by the isolator manufacturer based upon equipment that will be furnished and installed by the Contractor under this Contract.

1. Vibration isolation specialist shall coordinate his work with that of other trades to verify that equipment speeds, in revolutions per minute (rpm), are based upon actual equipment installed at the project site.

2. Verify that equipment rpm and spring deflection selected are arranged so that resonance is avoided.

2.3 ISOLATOR TYPES

A. Type 1 Isolators: Provide pad type vibration isolators consisting of either two layers of 3/8-inch (10 mm) thick elastomer, molded to contain a pattern with non-slip characteristics in all directions, and bonded to 16 gauge (1.6 mm) galvanized steel separator plates, or 1-inch (25 mm) thick precompressed molded fiberglass isolation pads. Minimum overall thickness shall be 1-inch (25 mm). Deflection shall be limited to 0.25 inches (6 mm) or less. Loading shall not exceed 40 pounds per square inch (280 kPa).

B. Type 2I Isolators: Provide double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in the top and bottom portions.

1. Deflections shall be limited to 0.5 inches (13 mm) or less.

2. Steel bases shall be drilled with mounting holes and equipment mounting points shall be threaded male or female connections.

3. Treat resilient material with antiozone and antioxidant additives.

C. Type 2H Hangers: Provide rubber-in-compression suspension hangers, consisting of a formed steel frame and elastomer isolation element and provided with attachments for top and bottom suspension rods.

1. Design for a minimum 200 percent overload without noticeable deformation or failure.

2. Metal components shall be galvanized or factory painted.

D. Type 3I Isolators: Provide adjustable, freestanding, open spring isolators with combination leveling and equipment fastening bases.

1. Spring elements shall be contained in upper and lower housing assemblies and shall have a minimum Kx-Ky of 0.75.

2. Design springs for a minimum travel of 50 percent beyond the rated load.

3. When fully compressed and "bottomed-out", isolators shall be capable of supporting a 150 percent overload without deformation and spring failure.

4. A minimum 1/4-inch (6 mm) thick non-skid isolation pad shall be bonded to the underside of the base plate.

5. Size base plates to limit floor loading to 100 pounds per square inch (690 kPa).

6. Drill base plates for bolting, as required.

7. Provide means for anchoring the top element of the isolator to rails and equipment.

E. Type 3H Hangers: Provide combination spring and elastomer hangers consisting of a formed steel frame with coil spring and elastomer insert in compression.

1. Design hangers to be capable of supporting a 200 percent overload without noticeable deformation or failure.

2. Design hangers to allow a 30 degree misalignment without binding or a reduction in hanger efficiency.

3. Design hangers for connection to equipment and supporting rods.

F. Type 4 Isolators: Provide vertically restrained, freestanding, laterally stable, open spring type isolators.

1. Design for deflection exceeding 1/2-inch (13 mm).

2. Provide built-in bearing and leveling provisions.

3. Provide a minimum 1/4-inch (6 mm) thick non-slip elastomer vibration absorbing pad bonded to the underside of the isolator base.

4. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.

5. Provide vertical limit stops to prevent hyperextension due to wind loads or upward movement when the load is removed. Limit stops shall not bind or inhibit spring movement during normal operating ranges.

6. For exterior applications, steel housings shall be hot dipped galvanized and springs shall be neoprene or powder coated.

G. Type 5 Thrust Restraints: Provide spring isolators of an adjustable, freestanding type enclosed within tubular mountings and arranged to be installed in pairs across the discharge of fan flexible connectors.

1. Design restraints to resist the thrust caused by duct internal air pressure.

2. Install restraints on duct systems with an internal static pressure exceeding 3 inches water gauge (750 Pa).

3. Restraints shall have the same deflection as isolators installed under the fans.

2.4 PIPING AND DUCTWORK

A. General: All ductwork and piping in mechanical equipment rooms and within fifty feet (15 m) of the vibration source (i.e. mechanical equipment such as air handling units, chillers, pumps, cooling towers, air compressors, etc.) shall be isolated from the building structure with flexible vibration isolators. Air handling units with less than two inches (500 Pa) of external static pressure shall be excluded from this requirement.

1. Suspend ductwork on Type 3H hangers.

2. Suspend piping on Type 3H hangers.

3. Floor-mounted ductwork and piping shall be supported with Type 4 spring isolators with deflections the same as the equipment to which the piping is attached.

B. Reciprocating Equipment: Provide spring type hangers with deflections equal to that of reciprocating equipment, with piping arranged with offset elbows to absorb vibration.

C. Risers: Pipe and duct risers within 100 feet (30 m) of mechanical equipment rooms shall be resiliently anchored to the building structure with Type 1 vibration isolators, near the midpoint of the risers.

1. Risers shall be isolated and supported at each second floor with pairs of Type 3H hangers, having deflections a minimum of five times the anticipated thermal movement at the support point.

2. Risers shall be guided as required with four (4) sets of Type 2I vibration isolators.

3. Provide flexible neoprene or canvas connectors as specified in sheet metal ductwork at the connection point to all air moving equipment.

4. Support ductwork with an internal pressure exceeding 3 inches (750 Pa) water with Type 3H hangers on maximum 10 foot (3 m) centers with deflections equal to the equipment isolators.

2.5 VIBRATION ISOLATION SYSTEM SELECTION

A. General: The following selections of vibration isolation equipment systems shall be considered as a minimum. For the equipment below, the following code applies:

Letter (i.e. A, B, C) = Base type

Number (i.e. 1, 2, 3, 4) = Isolator type

Decimal number (i.e. 0.25, 1.5, etc.) = Minimum deflection

B. Air-Cooled Condensing Units:

20 FOOT (6 M) ROOF SPAN	30 FOOT (9 M) ROOF SPAN	40 FOOT (12 M) ROOF SPAN
A 2 0.25	A 2 0.35	A 2 0.5

C. Low-Pressure AHU Locations (To 3-Inch W.G.) (750 Pa):

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Thru 10 hp (7.5 kW)	A 2 0.25	A 3 0.75	A 3 1.0	A 3 1.0
15 hp & over (11 kW & over) 250 to 500 rpm (26 to 52 Rad/s)	A 2 0.35	A 2 1.5	A 3 1.75	A 3 1.75
500 rpm (52 Rad/s)	A 2 0.35	A 3 1.0	A 3 1.5	A 3 1.75

Note: Where floor mounted air handling units are provided with internal vibration isolation for all vibration producing components, provide ¾" neoprene pads.

D. Air Moving Device Locations:

Vibration isolation provisions apply to housed or unhoused freestanding fans of any pressure rating, located in field-erected central-station units or in unhoused return air or supply air service.

TYPE EQUIPMENT	BASEMENT BELOW GRADE	20 FOOT (6M) FLOOR SPAN	30 FOOT (9 M) FLOOR SPAN	40 FOOT (12 M) FLOOR SPAN
Up to 5 hp (Up to 3.7 kW)	A or B 2 0.25	B 3 1.0	B 3 1.0	B 3 1.5
5 thru 40 hp (3.7 thru	B 3 1.5	B 3 1.5	B 3 1.5	B 3 2.5

29.8 kW) 200 to 500 rpm (21 to 52 Rad/s)				
500 rpm (52 Rad/s) & over)	B or C 3 0.75	C 3 0.75	C 3 1.5	C 3 2.5
Over 40 hp (Over 29.8 kW) 250 to 500 rpm (26 to 52 Rad/s)	B 3 0.75	C 2 1.5	C 3 2.5	C 3 2.5
500 rpm and over (52 Rad/s and over	B 3 0.75	C 3 1.5	C 3 1.5	C 3 2.5
Fan powered boxes and fan coil units	A 3 0.75	A 3 0.75	A 3 0.75	A 3 0.75

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manufacturer: All vibration isolation equipment shall be installed in accordance with the manufacturer's recommendations.

B. Manufacturer's Representative: The vibration isolation installation and deflection testing after equipment start-up shall be conducted by a representative of the manufacturer.

3.2 TESTS AND REPORTS

A. Testing: Each vibration isolation device shall be deflection tested. Two (2) copies of a bound report shall be submitted prior to final acceptance. The certification shall include the following:

1. Certify that equipment has been isolated in accordance with Contract Drawings, specifications and submittals.

2. Certify that all minimum specified deflections have been equaled or exceeded.

3.3 ANCHORING

A. Installation: Installation shall comply with manufacturer's published recommendations and shall be installed so that isolators are plumb and are operating at a manner for which they were designed.

1. Unless otherwise specified, all equipment shall be securely bolted to isolators, steel bases or concrete inertia bases.

2. Indoor vibration isolators need not be attached to the structure unless required by local codes.

3. Isolators installed outdoors shall be attached to building structure.

3.4 CLEANING

A. Debris: Remove all debris from under equipment, and thoroughly clean steel bases, inertia bases and check for free movement.

B. Adjustment: Adjust isolators as required for proper operation prior to starting equipment. Testing of vibration isolators shall be performed by a certified representative of the manufacturer as specified.

3.5 GENERAL

A. All exterior structural steel and/or steel housings of exterior vibration isolation materials shall be hot dipped galvanized.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of identification devices specified in this section include the following:

1. Pipe and Duct Markers
2. Painted Identification Materials
3. Underground-Type Plastic Line Marker
4. Valve Tags
5. Valve Schedule Frames
6. Engraved Plastic-Laminate Signs
7. Plastic Equipment Markers
8. Plasticized Tags

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 or Owner standards for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" (213 mm x 275 mm) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations

for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

C. Maintenance Data: Include product data and schedules in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers' products which may be incorporated in the work include the following:

1. Brady
2. Seton
3. Bunting
4. Brimar

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option but provide single selection for each product category.

2.3 PIPE AND DUCT MARKERS

A. Snap-on Type: Provide pre-printed, semi-rigid, snap-on color coded identification sleeves complying with ANSI A13.1. This type shall be used for insulated pipe sizes 2” and smaller.

B. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive, vinyl markers conforming to ANSI A13.1. This style marker shall be applied to all uninsulated piping; insulated piping 2-1/2” and larger, and all ductwork.

C. Flow Direction: Provide flow directional arrows either as part of markers, or separately attached to pipes and ducts.

2.4 PAINTED IDENTIFICATION MATERIALS

A. Piping and Equipment Systems: Continuous color coded painting of piping and equipment shall be provided in all mechanical rooms in compliance with ANSI A13.1.

2.5 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage (1.2 mm) polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" (6 mm) high letters and sequenced valve numbers 1/2" (13 mm) high, and with 5/32" (4 mm) hole for fastener.

1. Provide 1-1/2" (40 mm) diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.6 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with lexan.

1. Locate one schedule where directed. Provide second schedule to Owner framed in rigid plastic frame with rigid plastic glazing.

2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" (1.6 mm) for units up to 20 sq. in. (12900 mm^2) or 8" (200 mm) length; 1/8" for larger units.

B. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

C. Duty: Accident-prevention tags with appropriate wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.8 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and schedule number

2. Equipment service

2.9 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown on plans. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with pressure sensitive markers and arrows, showing ductwork service and direction of flow.

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 25 foot (7500 mm) spacings.

C. Access Doors: Provide duct markers on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed, locations, and concealed gas piping.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 25 feet (7500 mm) along each piping run.

C. Gas Pipe: Paint exposed gas pipe throughout (except chromium plated).

D.

3.4 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Schedule" of this section.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2.

3. Fans and blowers.

4. Packaged HVAC central-station and air handling units.

B. Lettering Size: Minimum 1/4" (6 mm) lettering for name of unit where viewing distance is less than 2'- 0" (600 mm - 0 mm), 1/2" (13 mm) high for distances up to 6'- 0" (1800 mm - 0 mm), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.6 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

3.8 IDENTIFICATION SCHEDULE

SERVICE	DESIGNATION
Refrigeration Suction	SUCTION
Refrigeration Liquid	LIQ

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of testing, adjusting, and balancing (TAB) work required by this section is indicated on drawings and schedules, and by requirements of this section, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow), adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports to achieve the capacities or setpoints indicated on the contract documents, and recommending modifications to work as required to achieve the capacities or setpoints indicated on the contract documents.

B. Component types of testing, adjusting, and balancing specified in this section shall include, but not be limited to, the following as applied to mechanical equipment:

1. Building automated systems
2. Fans
3. Air handling units
4. Ductwork systems
5. Piping systems
6. Terminal units
7. Air devices
8. Domestic hot water recirc pump and associated balance valves

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Tester's Qualifications: A firm certified by Associated Air Balance Council (AABC) who is not Installer of system to be tested.

1. AABC Compliance: Comply with the current AABC's Manual "AABC National Standards", as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
2. Industry Standards: Comply with AABC recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing, except as otherwise indicated.

3. ASHRAE Standard 111: Comply with current edition of ASHRAE 111, “Measurement, Testing, Adjusting and Balancing of HVAC Systems”.

4. Independence: TAB contractor shall be independently owned and operated with no affiliation with the general contractor, mechanical contractor, sheet metal contractor, design engineer, etc.

5. Experience: Each technician shall demonstrate a minimum of three years of actual test and balance field experience.

B. Pipe Testing Procedures: Contractor shall pressure test all piping systems in accordance with the following:

1. ASME Code for Pressure Piping B31, most current edition.

2. National Fire Protection Association (NFPA), all applicable sections, most current edition.

1.3 SUBMITTALS

A. Qualification: TAB contractor qualifications shall be provided as a formal submittal for review to demonstrate conformance with all qualifications indicated throughout the contract documents.

B. Submit certified test reports, signed by the AABC Test and Balance technician who performed the TAB work. In addition, the report shall be certified by an AABC certified Test and Balance Engineer (T.B.E.) who is familiar with the project.

1. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.

C. The Contractor shall maintain a copy of AABC standards on the site during all TAB work. Said document(s) shall be made available to Owner representatives for reference as to minimum requirements.

D. Maintenance Data: Include in maintenance manuals, copies of certified test reports, identification of instruments.

1.4 JOB CONDITIONS

A. Do not proceed with testing, adjusting, and balancing work until work has been completed, tested, operable, and all balancing devices indicated on the contract documents have been installed. Ensure that there is no residual work still to be completed on the equipment to be tested.

B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

1. Factory fabricated plastic plugs shall be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

A. Utilize test instruments and equipment for TAB work required, of type, precision, and capacity as recommended in the following TAB standards:

1. AABC's Manual "AABC National Standards".

2. Wherever permanently installed measuring equipment is provided, such as air volume monitors, flow meters, temperature and pressure gages, etc., these shall be used in addition to TAB instrumentation. Any discrepancies in accuracy shall be brought to the attention of the Owner. Where permanently installed instrumentation meets accuracy requirements for TAB work, they may be used provided TAB Contractor can verify calibration of installed instruments.

B. The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements.

PART 3 - EXECUTION

3.1 FIELD WORK

A. Prior to the mechanical installation, the mechanical and TAB contractors shall review the design documents for “balanceability” to confirm that all devices required to properly balance each system are to be provided under this contract. Recommended modifications and/or additions shall be made directly to the engineer and a minimum of 30 days prior to the installation of mechanical equipment.

B. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, operable and accessible. Do not proceed with TAB work until unsatisfactory conditions have been corrected.

C. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable AABC standards. All systems and components shall be balanced within $\pm$5% of design air and water flows.

D. Test, adjust and balance system during summer season for cooling and during winter season for heating systems, including operation at outside conditions within 3°F (2°C) wet bulb temperature of maximum summer design condition, and within 10°F (6°C) dry

bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.

E. For fan systems, provide sheave replacements where required to achieve specified air flows.

F. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

3.2 REPORTS

A. Prepare report of test results, including instrumentation calibration reports, in format recommended by AABC standards. Provide a System Summary page(s) at the front of the report.

B. An interim/preliminary handwritten report shall be submitted to the Engineer for review prior to the formal submission of the report.

C. Test reports shall include, but not be limited to, the following information:

1. Air Handling Equipment Test:

a. Air handling equipment shall include, but not be limited to, all fans (supply, exhaust, return, relief, make-up, ventilation, etc.), air handling units, fan coil units, unit ventilators, VRF terminals, chilled beams. etc.).

b. Design Conditions: CFM, static pressure, motor h.p., outside air CFM (where applicable), fan and motor RPM and fan motor h.p. for each fan.

c. Installed Equipment: Manufacturer, size, arrangement, class, motor h.p., volts, phase, cycles, and full load amps.

d. Field Test Results: Fan CFM, fan RPM, fan motor voltage, fan motor operating amps, fan motor operating b.h.p., total static pressure for each fan. In addition, where applicable provide external static pressure, air pressure drop across each coil, filter bank, attenuator, etc. (ie. provide total static pressure profile of each system), as well as leaving air temperature, outside air conditions (dry bulb/wet bulb) at time of test, coil flow data (GPM), coil entering and leaving air temperatures, coil entering and leaving water temperatures, coil water pressure drop, VFD settings at final test conditions, and duct static pressure setpoint. Air temperature difference measurements will not be acceptable.

2. Air Distribution Test: Main and major branch ducts and individual supply, return and exhaust terminals (VAV terminals, terminal reheat units, diffusers, registers and grilles):

a. Design Conditions: Ductwork: CFM, duct size. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.

b. Field Test Results: Ductwork: CFM, duct size, number of velocity readings, average velocity reading. Air terminals, diffusers, registers, grilles: CFM, module size and inlet size.

3. Miscellaneous Test Results:

a. All Coils: Air pressure drop, water pressure drop, water flow (GPM), air flow (CFM), entering water temperature, leaving water temperature, entering air temperature, leaving air temperature and outside air temperature at time of test (where applicable) and BTU calculations. Air temperature difference methods will not be acceptable.

b. Air Flow Monitors (AFM): Provide verification of AFM accuracy including set-up and adjustment required to verify proper operation and accuracy of each AFM system.

c. Sound Readings: Provide ten (10) sound power level readings at locations to be selected by the Engineer.

d. Balance Valves: All balance valves (including hydronic and domestic water) shall be adjusted and balanced to include water flow (GPM) and pressure drop (where applicable). Indicate manufacturer/model of each valve type.

3.3 TESTS - PIPING

A. Prior to the balancing of systems by the AABC certified balancing contractor, the mechanical contractor shall air and/or hydrostatically test the following systems in accordance with the latest ASME B31 (ASME Code for Pressure Piping) and NFPA requirements.

1. Air Test:

a.

b. Refrigeration Liquid and Suction Line

B. Pressure tests shall also be performed prior to the installation of all insulation materials.

C. Air Test:

1. Air, gas and vacuum piping shall be air tested at 200 psi (1380 kPa).

2. Refrigerant piping shall be air tested at 550 psi (3800 kPa) as follows:

a. Pressure Test (Air Tight Test): Pressurize the suction gas pipe, high/low pressure gas pipe and liquid pipe with dry nitrogen to a minimum pressure as per the system manufacturer. Pressure test duration shall be a minimum of 24 hours. If the pressure does not drop within the 24 hour period, the system passes. If there is a drop in pressure, check for leaks, make repairs and re-test as prescribed above.

b. Evacuation Test (Vacuum Drying): Evacuate the system from the suction gas pipe, high/low pressure gas pipe and liquid pipe to a minimum vacuum

pressure as per the system manufacturer. Vacuum pressure shall be maintained in accordance with manufacturer's minimum duration recommended. If it rises, the system may either contain moisture or have leaks, if so, make repairs and re-test as prescribed above.

c. Refer to the Refrigerant Leakage Test Summary Form at the end of this section to document test results. No other form will be acceptable. Submit results for all systems for review.

D. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

E. Refer to Division-23 section "Testing, Adjusting and Balancing" for additional specific test criteria and test form to be completed.

F. Sanitary and Storm Water Piping Systems:

1. All soil, waste, vent and storm water piping shall be tested by the Contractor and reviewed by the Architect before acceptance. All piping located underground shall be tested before backfilling. The costs of all equipment required for tests are to be included under the contract price.

2. The entire new drainage system and venting system shall have all necessary openings plugged and filled with water to the level of the highest vent stack above the roof. The system shall hold this water for four (4) hours without showing a drop in water level. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except a vertical stack 10 feet (3000 mm) above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure.

G. Drain test water from piping systems after testing and repair work has been completed.

H. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

I. Contractor shall submit piping leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Piping test results shall be recorded on the "Piping Leakage Test Summary Form (Hydronic and Air)" and "Piping Leakage Test Summary Form (Plumbing)" located at the end of this section; no other forms will be accepted. In addition, the pipe leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the piping test section (each piping test section shall be numbered and color coded).

3.4 TESTS - DUCTWORK

A. Prior to the balancing of systems by the AABC certified balancing contractor, all high and low pressure systems shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:

Ductwork systems less than 2.0 in. wg E.S.P.:

(Duct Pressure Class 2): Test to 2 in. wg

B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.

C. The balance contractor shall witness and certify all duct pressure tests.

D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the attached “Air Duct Leakage Test Summary Form” at the end of this section; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).

E. All duct leakage test results shall be included with the final TAB report and the O&M manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.5 TESTS - EQUIPMENT

A. The contractor shall verify calibration of all indicating, recording, controlling and controlled devices throughout the mechanical system. Verify the proper function of all installed equipment and devices and the interlocking of all new systems as required by the contract documents.

B. A report including successful calibration and function performance verification of all items indicated above shall be included in the Operations and Maintenance Manual.

3.6 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each chiller, boiler, air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.7 FINAL TESTS, INSPECTION AND ACCEPTANCE

A. At time of final inspection, Contractor shall recheck, in presence of Owner's Representative, random selections of data (water and air quantities, air motion, and sound levels) recorded in Certified Report. In addition, courtrooms, auditoriums, and conference rooms shall be rechecked. [Laboratories shall be rechecked for satisfactory air flow and motion in vicinity of and through hoods.]

1. Points and areas for recheck shall be selected by Owner's Representative.

2. Measurement and test procedures shall be same as approved for work forming basis of Certified Report.

3. Selection for recheck (specific plus random), in general, will not exceed 25 percent of total number tabulated in report, except that special air systems may require a complete recheck for safety reasons.

B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more, greater than that recorded in Certified Report listings, at 10 percent or more of the rechecked selections, report shall automatically be rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new Certified Reports submitted, and new inspection tests made, at no additional cost to the Owner.

C. Marking of Settings: Settings of valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time.

END OF SECTION 23 05 93

AIR DUCT LEAKAGE TEST SUMMARY FORM

Project Name: _____ Project Number: _____ Page __of__

DESIGN DATA						FIELD TEST DATA RECORD								
Duct Test Section (No./Color)	Air System	Total System CFM	Test Section CFM	Allowable Leakage %	Allowable Leakage CFM	Diameter		Pressure (in. w.g.)		Actual Leakage CFM	Actual Leakage %	Test Result Pass/Fail	Test Performed By (initials)	Test Witnessed By (initials)
						Orifice	Tube	Duct(1)	Across Orifice					
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										
				1.0%										

Testing Performed By: _____
(Company/Individual Name)

Witnessed/Certified By: _____
(Company/Individual Name)

(1) Duct test pressure shall be 6.0 in. w.g. for High/Medium Pressure ductwork, or 2.0 in. w.g. for Low Pressure ductwork.

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PIPING LEAKAGE TEST SUMMARY FORM

(HYDRONIC AND AIR)

Project Name: _____ Project Number: _____ Page _____ of _____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company:

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

(1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.
(2) 150% of operating pressure but not less than 100 psi (hydronic), 200 psi (air, gas and vacuum) and 400 psi (refrigerant).
(3) Four (4) hours minimum.
(4) Shall not exceed 0.0%.

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PIPING LEAKAGE TEST SUMMARY FORM

(REFRIGERANT PRESSURE TEST)

Project Name: _____ Project Number: _____ Page _____ of _____

System/Unit Tested (1)	Test Location	Test Pressure (2)	Actual Test Pressure	Test Start			Test Completion			Pressure Drop (4)	Pass/Fail
				Time	Temperature	Pressure	Time	Temperature	Pressure		

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

(1) Equipment designation.
(2) Per manufacturer's recommendation.
(3) Twenty-four hours minimum from start to completion.
(4) Shall not exceed 0.0%.

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PIPING LEAKAGE TEST SUMMARY FORM

(PLUMBING)

Project Name: _____ Project Number: _____ Page _____ of _____

System Tested	Sections Tested (1)	System Operating Pressure	Test Pressure (PSI/FT-HD) (2)	Duration (3)	Pressure Drop (4)	Pass/Fail

Name of Testing Agency/Company: _____

Date of Test(s): _____

Test Conducted By (Print/Sign): _____

(1) Identified by an 11 x 17 numbered and color coded test section plan. Plan shall accompany this test report.

(2) 150% of operating pressure but not less than 100 psi , 200 psi for air-gas-vacuum, 10 ft. static head pressure or to the maximum rating of the joint. Include joint cut sheets showing their ratings.

(3) Four (4) hours minimum.

(4) Shall not exceed 0.0%.

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SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, by requirements of this section, and all other Division-23 sections.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:
    a. Fiberglass
    b. Flexible Elastomeric
2. Ductwork System Insulation:
    a. Fiberglass
    b. Flexible Elastomeric
    c. Polyisocyanurate
3. Equipment Insulation:
    a. Fiberglass
    b. Flexible Elastomeric

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project. Provide installer’s certification by the manufacturer’s training program where applicable.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories, and intended use for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Owens Corning
2. Johns Manville
3. Certainteed
4. Armacell
5. Knauf
6. Aeroflex

2.2 PIPE INSULATION MATERIALS

A. Fiberglass Pipe Insulation: ASTM C 547, Type 1 (up to 850°F) (up to 454°C), maximum k-value of 0.23 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F.

B. Flexible Elastomeric Pipe Insulation: ASTM C 534, Type I (-40°F to 200°F) (-40°C to 93°C), maximum k-value of 0.25 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F.

C. Jackets for Piping Insulation: Jacket assembly shall be ASTM C 1136, Type I with vapor retarder (0.02 perms). All service jackets shall have a polymer coated exterior facing, shall resist water staining and shall not support mold or mildew growth. All service jackets shall be Owens Corning ASJ Max with SSLII closure system, or equivalent.

1. All fittings shall be provided with pre-molded insulation with equivalent thickness and composition of insulation applied to the adjoining piping. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

2. Encase exterior piping insulation with 26 gauge embossed aluminum jacket with weather-proof construction.

D. Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealer, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 DUCTWORK INSULATION MATERIALS (INDOOR)

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C), minimum k-value of 0.27 BTU-in/hr-ft^2-deg F at a mean temperature of 75°F (24°C).

B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, maximum k-value of 0.27 BTU-in/hr-ft^2-deg F or minimum “out of package” R-value of 6.7 at a mean temperature of 75˚F. For ductwork in ceiling space directly below roof, provide insulation with maximum k-value of 0.25 and minimum “out of package” R-value of 8.0 (1.5 LBS/FT^3 density).

C. Flexible Elastomeric Duct Wrap Insulation ASTM C 534, Type II, R-value of 8.0 at 2”, (-40°C to 93°C).

D. Ductwork Insulation Accessories: Provide bands, wires, tape, anchors, corner angles, and similar accessories as recommended by insulation manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 OUTDOOR DUCT INSULATION SYSTEM (PRE-MANUFACTURED)

A. Pre-manufactured panel system shall consist of four (4) piece interlocking panels.

B. The interlocking panels shall be constructed of Dow Thermax polyisocyanurate insulation, ASDTM D-1622, nominal 2 pcf; water vapor transmission permeance less than 0.03, per ASTM E-96; water absorption less than 0.3% (24 hours), per ASTM C-209; flexural strength more than 40 psi, per ASTM C-203

C. Operating temperature range of -100°F to +250°F.

D. Insulation shall be laminated in two (2) layers to provide an installed system value of R-16 at 2 inch thickness, per ASTM C-236/C-518.

E. The insulation shall be clad with 0.032" thick embossed aluminum and sealed with vapor barrier compound. All joints shall interlock to ensure a thermal seal with no pass through seams.

F. Panels shall be secured with #10 self-tapping stainless screws with weather seal washers.

G. Manufacturer: Techna-Duc Insulation System as manufactured by P.T.M. Manufacturing, L.L.C., Newark, Delaware.

2.5 OUTDOOR DUCT INSULATION SYSTEM (FIELD INSTALLED)

A. Field-installed insulation system shall consist of two inches of elastomeric foam insulation clad in 0.032 embossed aluminum weather barrier delivering an installed thermal value of R-8.

B. The insulation material shall be elastomeric foam insulation, ASTM C-534, water vapor transmission permeance 0.08, per ASTM E-96, procedure A; water absorption 0.2% (24 hours), per ASTM C-209.

C. Operating range of -100°F to +250°F.

D. Insulation shall provide an installed value of R-8 at 2 inch thickness, per ASTM C-236/C-518. Insulation shall be fully adhered to the cleaned, oil free duct substrate utilizing an approved contact adhesive. All butt edge seams shall be likewise fully adhered.

E. The insulation shall be clad with 0.032" thick embossed aluminum, either factory applied or field applied, and sealed with vapor barrier compound. All joints shall interlock to ensure a thermal seal with no pass through seams.

F. Metal jacketing shall be secured with #10 self-tapping stainless screws or stainless steel pop rivets.

G. Manufacturers: Armacell, K-Flex

2.6 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612-00, Type 1A (up to 450°F) (up to 232°C).

B. Flexible Elastomeric Cellular Sheet Insulation: ASTM C 534, Type 2, R-value of 8.0 at 2", (-40°F to 200°F) (-40°C to 93°C).

C. Jacketing Material for Equipment Insulation: Provide 8 ounce (227 g) canvas or pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard (263 g/m^2), or metal jacket at Installer's option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide bands, wire, wire netting, tape corner angles, anchors, stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Only install mechanical insulation on systems while not in operation.

3.2 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures and air conditioning condensate piping in mechanical rooms and/or on roofs.

B. Refrigerant Piping (0 Degrees F - 200 Degrees F) (-18 Degrees C –93 Degrees C):

1. Application Requirements: Insulate the following HVAC piping systems:

a. All refrigerant piping (gas and liquid).

2. Insulate piping system(s) specified above with the following type and thickness of insulation:

a. Flexible Elastomeric: 1" (25 mm) thick.

C. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by the manufacturer.

3.3 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork located inside the building.

B. Cold Ductwork:

1. Application Requirements: Insulate the following cold ductwork:

a. Unconditioned outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.

b. HVAC supply air ductwork from air handling unit/fan discharge to diffuser or register, including all duct accessories (sound attenuators, etc.).

c. HVAC conditioned outside air ductwork connected to DOAS (dedicated outside air) system from unit discharge to diffuser or register.

d. HVAC return ductwork located in ceiling directly adjacent to roof, including all duct accessories (sound attenuators, etc.).

e. HVAC exhaust ductwork located in ceiling directly adjacent to roof, connected to DOAS (dedicated outside air) system.

f. HVAC plenums and unit housings not preinsulated at factory or lined.

g. Insulate neck and bells of supply diffusers.

h. External portions of air terminal (VAV, TRU's) heating coils.

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Flexible Fiberglass: 2" (50 mm) thick with R-value of 6.7 (provide 2" thick with minimum R-value of 8.0 for supply ductwork located in ceiling space directly below roof), application limited to concealed locations.

b. Rigid Fiberglass: 2" (50 mm) thick, application limited to ductwork exposed to view, including mechanical rooms.

C. Hot Ductwork (Above Ambient Temperature):

1. Application Requirements: Insulate the following hot ductwork:

a. Hot supply and return ductwork between fan discharge, or heating unit discharge, and room diffuser/register; except omit insulation on return ductwork located in return air ceiling plenums.

b. Heating plenums and unit housings not pre-insulated at factory.

2. Insulate each ductwork system specified above with the following type and thickness of insulation:

a. Flexible Fiberglass: 2" (50 mm) thick.

D. Outdoor Ductwork:

1. Application Requirements: Insulate the following ductwork:

a. All outdoor ductwork (including lined or double wall lined ductwork).

2. Insulate all outdoor ductwork in accordance with paragraph 2.4 or 2.5 of this section.

3.4 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:

a. Drip pans under chilled equipment

2. Insulate each item of equipment specified above with the following type and thickness of insulation:

a. Flexible Elastomeric: 2" (50 mm) thick for surfaces above 35°F (2°C) and 3" (75 mm) thick for surfaces 35°F (2°C) and lower.

B. Breeching, Stack, and Emergency Generator Insulation:

1. Application Requirements: Insulate the following breechings and stacks:

a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

b. Stacks from bottom to top except for factory insulated stacks.

c. Emergency generator exhaust.

2. Insulate each breeching, stack and generator exhaust specified above with one of the following types and thicknesses of insulation:

a. Rigid Fiberglass: 3-1/2" (89 mm) thick.

3.5 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Provide factory molded insulation or pre-fabricated fittings for all valves, fittings, unions, etc. Valve handles must be extended by the mechanical contractor to accommodate the insulation without reducing the thickness or integrity of the valve insulation.

G. All water test ports shall be accessible from the insulation. In addition, water flow measuring stations require access from insulation to verify sizes and model.

H. Extend piping insulation without interruption through pipe hangers, walls, floors and similar piping penetrations, except where otherwise indicated.

I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" (75 mm) wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" (75 mm) wide vapor barrier tape or band. If using pipe hangers, follow manufacturer's instructions for installation.

J. All exposed pipe insulation, including fittings, above 8'- 0" (2400 mm - 0 mm) of finished floor shall have 8 oz. (227 g) fire retardant canvas cover neatly cut and parted seams shall be sealed.

K. All exposed pipe insulation, including fittings, within 8' - 0" (2400 mm - 0 mm) of finished floor or within a stairwell, shall be provided with aluminum or PVC protective covers. All edges shall be hemmed and all seams shall be concealed.

L. All exterior piping shall be provided with an embossed aluminum jacket.

M. For all insulated piping 2-1/2" (63 mm) and larger, provide insulated saddles as follows:

1. For chilled water and condenser water, as well as heating water and low pressure steam (up to 250ºF), provide the following:

    a. Minimum 3.5 pcf, non-compressive, rigid, phenolic foam insulation. Fire and smoke rating shall be 25/50 or below per ASTM 84.

    b. For cold applications below 75ºF (24ºC) a zero permeability abuse resistant vapor barrier shall be provided with matching butt strips. Apply a full coating of butyl joint sealant in addition to the butt strips for a completely sealed system.

    c. The phenolic foam system shall have a K factor of 0.16 at a mean temperature for 75ºF (24ºC) and comply with ASTM Standard C1126.

    d. Provide visible inspection sticker at the bottom of each saddle.

    e. Pipe insulation saddles shall be Tru-Balance CoolDry Saddles as manufactured by Buckaroos, Inc. or equivalent.

    f. Armacell Armafix Pipe Hangers may be used for cold water piping with flexible elastomeric insulation.

2. For medium and high pressure steam operating above 250ºF, provide the following:

    a. Non-compressive, rigid calcium silicate insulation. Fire and smoke rating shall be 25/50 or below per ASTM E84.

b. The calcium silicate insulation shall have a compression rating of 100 psi or higher and thermal conductivity K factor of 0.50 at a mean temperature of 300ºF per ASTM Standard C533.

c. The insulation shall be protected with an abuse resistant vapor/moisture barrier. Seal the longitudinal and butt joints with matching tape.

d. Secure the insulated saddle with metal banding on both sides. Provide visible inspection sticker at the bottom of each saddle.

e. Pipe insulation saddles shall be Tru-Balance 1200E as manufactured by Buckaroos, Inc. or equivalent.

3.6 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

2. Install insulation materials with smooth and even surfaces.

3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Seal all joints with vapor barrier material.

5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

B. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound lining has been specified.

C. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

D. All balancing damper handles shall be exposed and visible on externally insulated ductwork.

3.7 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

1. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet pressure testing requirements indicated throughout these specifications.

2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

4. Do not apply insulation to equipment, breechings, or stacks while equipment is operating.

5. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

6. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

7. If using fiberglass insulation, cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2" (50 mm). Apply over vapor barrier where applicable.

8. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

9. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

B. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.8 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division-23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

3.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

3.10 EXISTING INSULATION REPAIR/REPLACEMENT

A. Repair damaged sections of existing mechanical insulation, either previously damaged or damaged during this construction period. Insulation shall be as specified herein.

B. Provide new insulation on existing mechanical piping where existing insulation has been removed due to damage, repair or abatement of existing hazardous materials.

3.11 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00

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SECTION 23 0800 - COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The Drawings and general provisions of the Contract, including the City of Baltimore Department of Public Works Specifications (the “Green Book”) and other Division 01 Specification Sections, apply to this Section.

B. Section includes commissioning process requirements for HVAC systems, assemblies, and equipment. This section is intended to supplement and further detail the Commissioning requirements listed in Division 1.

C. Related Sections:

1. Section 019113 - "General Commissioning Requirements"

D. All tasks listed in this section are assumed to be the responsibility of the GC and their Sub-contractors, unless explicitly stated otherwise.

E. The following systems and/or equipment shall be commissioned:

1. All HVAC equipment and systems
2. Building Automation System

1.2 CONTRACTOR'S RESPONSIBILITIES

A. The contractor’s responsibilities include but are not limited to the following:
1. Perform commissioning tests at the direction of the Commissioning Agent (CA).
2. Attend construction phase commissioning coordination meeting.
3. Provide information requested by the CA for final commissioning documentation.
4. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.3 COMMISSIONING DOCUMENTATION

A. Documentation to be provided by the contractor includes, but is not limited to, the following:

1. Factory testing reports
2. Field testing reports
3. Equipment and system startup reports
4. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
5. Test and inspection reports.

6. Corrective action documents.
7. Completed and signed pre-functional checklists
8. Completed TAB pencil copy and final reports, by system.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CA.

3.2 TESTING AND BALANCING VERIFICATION

A. Notify the CA at least 3 days in advance of testing and balancing Work, and provide access for the CA to witness testing and balancing Work.

B. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CA.

1. The CA will notify testing and balancing Subcontractor 3 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes a deviation of more than the allowable tolerance specified in the “Test and Balance” Specification Section, or 10%, whichever is more stringent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report.
4. Remedy the deficiency and notify the CA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CA.

B. Scope of HVAC&R testing shall include the conditioned common areas and living spaces for this project. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and verify proper response of building automation system controllers and sensors.

D. The CA along with the HVAC Subcontractor, testing and balancing Subcontractor, and HVAC Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Provide equipment to simulate loads. Set simulated conditions as directed by the CA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CA may direct that set points be altered when simulating conditions is not practical.

G. The CA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC Instrumentation and Control System Testing: Field testing plans and testing requirements are specified on the mechanical drawings. Assist the CxA with preparation of testing plans.

B. The commissioning plan lists the specific equipment to be commissioned.

END OF SECTION 230800

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SECTION 23 09 00 - AUTOMATIC CONTROL SYSTEMS (ELECTRIC-ELECTRONIC)

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The extent of automatic controls work is indicated on the drawings and schedules and by the requirements of this Section, and all other Division-23 sections. The work includes, but is not limited to the following:

1. The provision of a complete and operational control system, including all devices necessary to perform the functions herein described or indicated on the drawings.

2. The provision of 120 and 208 volt line voltage and 5 and 24 volt low voltage wiring and conduit types shall be installed in accordance with Division-26 of these specifications.

3. The ATC contractor shall furnish and install all electrical wiring and conduit from power source, including termination, to all required ATC related power connections including, but not limited to, DDC controllers (provide low voltage controllers for air terminal units including transformers and disconnect switches as required), sensors, valve and damper actuators (including smoke dampers), air flow monitors, ATC panels, etc. The ATC contractor shall obtain a separate electrical permit as required by the local authority. The ATC contractor shall be wholly responsible for all power requirements necessary for a complete installation from the power source to all ATC related connections. All electrical work shall be installed in accordance with Division-26 of these specifications.

4. The ATC contractor shall interface with fire alarm devices as required to accomplish equipment shutdown, alarms, etc. indicated in sequences.

5. The ATC contractor shall coordinate and verify that all controllers, devices, and accessories are provided as required to accomplish all control functions and sequences indicated in the contract documents. Where control related devices are not provided by an equipment manufacturer, it shall be the responsibility of the ATC contractor to provide the control devices required to accomplish the functions and sequences indicated.

6. All drilling, cutting and patching associated with the installation of control systems.

B. Types: Provide automatic control systems of the following types:

1. Direct Digital Control (DDC) with electric actuation of valve and damper actuators.

2. The automatic temperature control system shall include remote interface and web access capability. All building management system control features including, but not limited to, points, alarms, scheduling, graphics, trending, etc. shall be available for control and monitoring through web

access as well as remote interface (coordinate exact location with the using agency, where applicable).

1.2 QUALITY ASSURANCE

A. Systems Engineering: The systems engineering phase shall include the selection and integration of components into a complete system which will meet the performance and prescriptive requirements of the Contract, together with drawings, specifications, descriptions of operation, diagrams and other materials listed under "Submittals" paragraph of this Section.

B. Testing and Adjusting During and After Installation:

1. The testing and adjusting includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated, adjusted, and retested after installation in accordance with the specified sequences of operation and other characteristics of the control system. A report on test results, including set points and operating ranges of all components shall be submitted.

2. The testing specified in this paragraph shall not replace the testing specified in "Commissioning Tests and Verification" article of this Section.

C. Commissioning Testing and Verifications: The final phase of the quality assurance program of the project is the commissioning testing and verifications. This phase is to assure that the project is fully completed and that the systems are performing in accordance to specifications from end to end of the control systems. Demonstrations of the automatic control systems to the commissioning team in accordance to the requirements specified in Part 3 of this Section are required. A report on test results, including set points and operating ranges of all components, shall be submitted.

D. Testing: The testing phase of quality assurance includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, calibrated and retested after installation to perform in accordance with the specified sequences of operation and other characteristics of the control system.

E. Reporting and Demonstration: This phase shall include the submission of a written report describing the "actions taken during the testing" phase, and including the set points and operating ranges of all equipment and a demonstration that the system performs in accordance with contract requirements.

F. Operating Instructions and Training: This phase of quality assurance includes the training of operating personnel utilizing written operating instructions prepared and approved under the "Submittals" paragraph of this Section, and the mounting of laminated control diagrams where directed.

G. Maintenance Manuals: This phase includes the submission of four hard bound copies of all manufacturers' cuts, maintenance and operating instructions, test reports and demonstration material, copies of control diagrams, and copies of the manufacturers' certifications.

1.3 SUBMITTALS

A. Shop Drawings: For each system to be controlled, prepare a drawing which includes a system flow diagram, control diagram, sequence of operation and schedule of components. Control diagrams shall be complete with end-to-end connections of piping and wiring from component terminal.

B. Manufacturer's Data: For each manufactured device or subsystem submit manufacturers' specifications and printed photograph of the proposed device or subsystem. Include engineering descriptions, principle of operation and application, and proposed model, style or size clearly indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The automatic temperature controls shall be furnished, installed, commissioned and warranted by one of the following acceptable providers:

1. Johnson Controls, Inc.

2. Siemens Building Technologies

3. Honeywell

4. Trane

B. No distributors, wholesalers or manufacturers’ representatives other than those listed above will be acceptable. In addition, manufacturers not listed above will not be acceptable.

2.2 SYSTEMS INTEGRATION

A. Control Loop Characteristics: Carefully evaluate the characteristics of each control loop, the time constants, equipment characteristics, control accuracy, and reliability and provide a system which will operate smoothly, without hunting, and within the accuracies specified.

B. System Components: Select components including sensors, transmitters, controllers, control devices, actuators, and instrumentation considering such factors as hysteresis, relaxation time, span, limits, and response time.

2.3 CONTROLLERS

A. General: Provide electric or electronic controllers for each local control loop.

1. Provide controllers with local adjustable setpoint, adjustable proportional band for analog controllers or adjustable differential for two position controllers.

2. Provide adjustable secondary input authority for dual input controllers with remote setpoint adjustment.

3. Provide integral or test connections for measuring input and output signal.

B. Electric/Electronic System Characteristics: Provide a system of control which shall have all of the following system characteristics. Systems which do not conform to all of the following requirements will not be acceptable.

1. The system shall consist of multiple, field adjustable controllers. The controller, power supplies, input/output and other components specified, including metal cabinet will be referred to as a "Field Panel."

2. The field panel shall be capable of performing its assigned local loop control and other functions as a standalone unit. It shall perform all specified local loop control functions without interaction to other field panels, except for shared functions such as central time programs, heating-cooling changeover, etc.

3. The field panel shall utilize control algorithms that permit proportional, integral, and derivative control as required. Control algorithms shall permit one, two or three mode control as specified or indicated on the drawings.

4. Each field panel shall be capable of handling multiple control loops, with one or more controllers.

5. The system shall utilize industry standard sensors.

6. The field panel shall provide both analog and binary output control. Analog outputs shall be compatible with industry standard transducers. Provide a modulating analog output control signal. Binary output control commands shall be implemented through interposing control relays.

7. Field panels shall be of modular construction. The system shall utilize interchangeable components. The modular construction of the system shall permit quick repair, ease of expansion, and the use of standard controls.

8. Each field panel with sensors and controlled devices shall be capable of automatic, unattended restart in the event of electrical power failure. In the event of electrical power failure all controlled devices shall move to their predetermined "normal" positions. By normal, it is meant that spring-close valves shall close, spring-open devices shall open, spring return devices will return and magnetically held devices will move to the position dictated by the force of gravity. Upon the restoration of electrical power, the field panel shall automatically restart and provide control to its connected systems after power failures of up to 72 hours.

9. The field panel operating system shall reside in nonvolatile memory.

10. Site specific application data, setpoints and operator entered data shall be stored in volatile memory.

11. Nonvolatile memory shall include PROM, EPROM, EAROM, ROM and RAM.

12. The preceding terms describe a class of solid state semi-conductor memories manufactured with LSI (large-scale-integration) techniques. These terms are expanded as follows:

a. PROM - Programmable Read Only Memory

b. EPROM - Erasable PROM

c. EAROM - Electrically Alterable ROM

d. ROM - Read Only Memory

e. RAM - Random Access Memory

C. Field Panels: Provide field panels as follows.

1. Each field panel shall consist of a controller, power supplies, input/output modules, and other components specified.

2. Provide field panels where indicated. Provide additional controllers, if required, to support the control loops specified, the sequence of operations, number of monitoring points or other criteria to permit the field panel capacity to meet the specified functional requirements of the project.

3. Each field panel shall be capable of operation as a completely independent unit.

4. Each field panel or controller shall include its own operator's keypad or other means of adjustment on site by the operator.

5. Each field panel shall receive signals from industry standard sensors and input devices. Each panel shall have the capability to monitor the following types of inputs:

a. Analog inputs: 4 to 20 mA and 0 to 10 V DC.

b. Binary inputs: Dry contact closure and pulse accumulator.

c. Provide transducers and/or signal conditioning to adapt other sensor types.

d. Field panels that permit the direct connection of resistance type sensors will be acceptable if the system accuracy, data resolution, value accuracy and sensor interchangeability, comply with all other requirements of the specification.

6. The field panel shall directly control actuators and control devices. Each field panel shall be able to provide the following control outputs:

a. Binary outputs: Contact closure

b. Analog outputs: 4 to 20 mA, 0 to 10 V DC and 0 to135 OHM.

c. Systems that do not provide direct analog outputs will be acceptable providing that they generate the specified output signal through transducers.

7. Each field panel shall perform control functions and other routines, specified under Sequences of Operation.

8. Each field panel shall accept binary inputs, on-off, open-close, or other two state data. Provide isolation and protection against input voltage up to 180 VAC peak.

9. Each field panel shall provide Binary Output by contact closures for momentary and maintained operation of field devices. Provide electromagnetic interference suppression on all output lines to limit transients to non-damaging levels. Provide isolation and protection against voltage up to 180 VAC peak. Provide contacts rated for 2 A at 24 VAC.

10. Each field panel shall be enclosed in a metal cabinet. The cabinet shall be constructed of 16 US gauge sheet steel, Provide sufficient access for wire and conduit to enter the cabinet. The cabinet shall have a hinge door and a pin tumbler lock. All field panel locks for the project shall be keyed alike. The cabinet shall be shipped to the project for installation without electronics. The electronics shall be added at the time of wire termination and system commissioning. All control wiring and system communications shall be electrically terminated inside the field panel.

11. Provide a 15A duplex receptacle inside or immediately adjacent to the field panel. The receptacle shall be energized when power is disconnected from the field panel.

12. Ground the field panel and power supply with a minimum No. 12 THHN unbroken ground wire to the building earth ground system. There shall be a maximum of 5 ohms measured between the ground at the field panel and the building ground system.

13. Provide a master electrical power disconnect switch inside the field panel to disconnect all external power to the cabinet for maintenance and repair. The disconnect switch shall not affect the duplex receptacle hereinbefore specified.

14. Provide screw type terminal strips in the field panel for the termination of all field wiring. Lay out terminal strips in a neat and orderly fashion and label each termination. All wiring entering the panel shall be routed through the panel wireways in a neat and workmanlike manner, properly tied or laced and terminated.

15. Provide conduit and wire to connect the field panel to the nearest adequate source of emergency electric power.

D. Wire/Cable Labeling: Label wire and cable as follows.

1. Label each cable and each conductor within 6 inches (150 mm) of the termination point. Cable and wire identification shall match the wiring identification shown on the installation and record drawings.

2. Wire identification labels shall be securely affixed to the wire and shall be of the preprinted type providing a durable vinyl or plastic covering over the printed lettering.

3. Wire identification through color coding, embossed label tape, paper tags attached with string and handwritten labeling will not be acceptable.

E. Transient Protection: Provide transient protection as required by the manufacturer.

F. System Accuracy: Provide system accuracy in accordance with the following.

1. Each local system shall maintain end-to-end accuracy for one year from sensor to controlled device for the applications specified.

2. Space temperature with a range of 50°F to 85°F (10°C to 29°C) plus or minus 0.75°F (.4°C) for conditioned space; 30°F to 130°F (-1°C to 54°C) plus or minus 1.0°F (.6°C) for unconditioned space.

3. Duct temperature with a range of 40°F to 140°F (4°C to 60°C) plus or minus 1.0°F (.6°C).

4. Outside air (OA) temperature with a range of minus 30°F to plus 130°F (minus -1°C to plus 54°C) plus or minus 2.0°F; with a subrange of plus 30°F to plus 100°F (plus -1°C to plus 38°C) plus or minus 1.0°F (.6°C).

5. Water temperature with a range of 33°F to 100°F (1°C to 38°C) plus or minus 0.75°F (.4°C); the range of 100°F to 250°F (38°C to 121°C) plus or minus 2.0°F (1.2°C); and water temperatures for the purpose of performing BTU calculations using differential temperatures to plus or minus 0.5°F (.3°C) using matched sensors.

6. High temperature water with a range of 0°F to 500°F (-18°C to 260°C) plus or minus 3.0°F (1.6°C).

7. Pressure with a range for the specific application plus or minus 2.0 percent of range.

8. Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of BTU calculations to plus or minus 2.0 percent of range.

G. Accuracy and Stability: Equipment shall be selected for the appropriate range of the application. Equipment selected with ranges in excess of the application will be replaced at the Contractor's expense.

2.4 SENSORS

A. General: Provide analog sensors for temperature controllers. Provide sensors with an output signal that varies continuously with the sensed temperature, within a specified range, of the thermistor or resistance type.

B. Manufacturer: Temperature sensors shall be made by one manufacturer.

C. Space Sensors: Provide space or room sensors with base plates thru-bolted into masonry or wall studs, brushed cast aluminum or 16 gauge (1.6 mm) ground and polished Type 316 stainless steel covers.

D. Insertion Type: Stem or extended surface sensitive type with screw mounting plate and galvanized sheet steel insulation mounting box.

E. Immersion Type: Stem or tip sensitive type with threaded immersion well base.

F. Sensing Elements: Hermetically seal, except for bimetal type for room thermostats. Stem, tip or extended element shall be Type 304 stainless steel or annealed copper.

G. Casing: Casing shall be constructed of watertight, vibration-proof, heat resistant high strength phenolic or 316 stainless steel.

H. Sensor Wells: Provide 304 stainless steel, bronze, copper or monel machined wells, compatible with the immersion medium, and heat sensitive transfer material or liquid between sensor and well surface.

2.5 ELECTRONIC ANALOG SENSORS

A. Range: Sensors shall operate within the range of minus 30°F to plus 220°F (minus -34°C to plus 104°C) for heating, ventilating and air conditioning (HVAC) systems.

B. High Temperature Sensors: For high temperature water applications provide sensors with a range of 0°F to 500°F (-18°C to 260°C).

C. Accuracy: Provide electronic analog sensors with an accuracy of plus or minus 0.25°F (.14°C).

D. Time Constant Response: Provide sensors with a time constant response to achieve 60 percent of a step temperature change in six (6) seconds in air or water flowing at 3 feet per second (.9 m/s).

E. Interchangeability: Sensors of the same type shall be interchangeable without calibration.

2.6 PRESSURE SENSORS

A. Overpressure Protection: Provide pressure sensors impervious to instantaneous pressure changes of 150 percent of working pressure but not less than plus or minus 50 psig (340 kPa).

B. Adjustment: Provide sensors with external adjustable span, adjustable zero and pulsation suppression.

C. Finished Spaces: Conceal pressure sensors in recessed stainless steel housing with removable perforated brushed stainless steel cover.

D. Sensor Characteristics: Provide pressure sensors with the following characteristics:

1. Ambient Temperature: 40°F to 140°F (4°C to 60°C).

2. Isolation Valves: Provide pressure sensors with stainless steel needle isolation valves between each sensor and sensor pressure source. Provide differential pressure sensors with 3-valve manifold for isolation and nulling.

3. Siphon: On steam systems provide pressure sensors with a pigtail siphon between the sensor isolation valve and sensor. Provide condensate wells and blowdown valves for differential pressure sensors.

4. Provide switching type sensors with platinum alloy, silver alloy or gold plated wiping contacts rated for the application, voltage and power levels.

5. Provide valved calibration taps adjacent to each pressure sensor for calibration.

2.7 STATIC PRESSURE ANALOG SENSORS

A. Types: Provide diaphragm sensors with solid state pre-amplifier electronic systems.

B. Characteristics: Provide analog sensors with the following characteristics:

1. Sensor span shall be not less than 150 percent and not more than 300 percent of the working pressure.

2. Accuracy shall be 0.5 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

2.8 DIFFERENTIAL PRESSURE ANALOG SENSORS

A. Types: Provide differential pressure analog sensors of the solid state pre-amplifier types for electronic systems.

B. Characteristics: Provide sensors with the following characteristics:

1. Sensor span not less than 150 percent nor more than 300 percent of the working differential pressure.

2. Accuracy of 0.5 percent of calibrated span, including combined effects of linearity, hysteresis and repeatability.

3. Pressure sensor shall withstand overpressure of not less than 200 percent working pressure and full vacuum underpressure without damage, changes in sensor accuracy or deformation.

2.9 DEW POINT AND RELATIVE HUMIDITY SENSORS

A. Dew Point Sensors: Provide analog salt-phase transition or dual cooled mirror type sensors with an accuracy of plus or minus 3°F (1.6°C) dew point over the range of 10°F to 100°F (-12°C to 38°C) dew point.

B. Relative Humidity Sensors: Provide analog precision resistance or hydro-mechanical gauge type relative humidity sensors, with an accuracy of plus

or minus 2 percent of relative humidity over a range of 10 to 90 percent relative humidity.

C. Shields: Provide 316 stainless steel weatherhoods and shields to protect outdoor sensors from sunlight, snow, ice, wind and rain and provide fan powered aspirator complete with wiring if recommended by the manufacturer.

D. Indoor Covers: Sensors located in public spaces shall have brushed 16 gauge (1.6 mm) 316 stainless steel covers or recessed aspirating boxes with Allen head screw mounting plate.

2.10 THERMOSTATS

A. Types: Provide electronic thermostats which operate in an analog proportional or binary two-position mode as required by the sequence of operation.

B. Mounting: Mount thermostats in non-public spaces except room thermostats.

C. Electric Analog Thermostats: Provide electric analog thermostat with the following characteristics:

1. Sensor shall be of the bulb or capillary type which shall actuate a 135 ohm 3-wire potentiometer for 0-10 VDC, or 4-20 milliamp proportioning control action of balanced bridge motor actuators.

2. Sensor shall have adjustable setpoint range of not less than 80°F (27°C) throughout the range of 0°F to plus 250°F (-18°C to plus 121°C).

3. Adjustable proportional band ranges from 3°F to 25°F (-16°C to -4°C) and capillary length of not less than 5 feet (1500 mm) shall be provided.

D. Electric Two Position Duct and Immersion Thermostats: Provide thermostats with bimetal or bulb and capillary type sensor actuating one or more switching contacts.

1. Contact shall be rated for the imposed load or shall be a pilot duty type and provided with a control relay.

2. Thermostats shall have adjustable setpoint throughout the range 0°F to plus 250°F (-18°C to plus 124°C).

3. Differential shall be adjustable from 3°F to 10°F (-16°C to -12°C) for each contact for refrigeration, boiler and industrial applications.

4. Fixed differential thermostats with differentials of 3 may be provided for On-Off control of unit heaters, ventilating fans and similar applications.

5. Provide capillary tubes in the 5 to 20 feet (1500 to 6000 mm) lengths to suit applications.

E. Freeze Protection Thermostats: Electric freeze protection thermostats shall be provided with capillary elements, and special purpose insertion elements not less than 20 feet (6000 mm) in length for the face of coils up to 80 square feet (7.4 m^2). Freeze protection thermostats shall have the following characteristics:

1. A freezing condition at any one foot length increment anywhere along the sensing element shall activate the thermostatic switch.

2. Switch shall require manual reset.

F. Weather Shields: Provide weather shields and outside air sensing elements with the following characteristics:

1. Mount elements and shields on the north face of the building or location out of direct sunlight.

2. Construct shields of 16 gauge (1.6 mm) 316 stainless steel with flanges bolted to a backplate with not less than four 1/4-inch (6 mm) diameter stainless steel bolts. Mount backplate to the building structure with expansion bolts.

3. Construct shields to inhibit solar effects. Construct shields in a rectangular box configuration with ventilating raintight louvers to preclude the entrance of snow, ice and rain. Design for crossflow and vertical air circulation.

4. Mount shields accessible for maintenance.

5. Seal wall penetration watertight.

6. All space thermostats shall provide local adjustability and programmable at the BAS, including override of local adjustability of the BAS

2.11 PRESSURE CONTROLLERS

A. Types: Provide electric electronic pressure controllers of the analog or two-position type as required by the sequence of operation.

B. Analog Controllers: Provide controllers with proportional action plus integral and derivative control modes.

1. Provide sensing elements of the differential type measuring controlled medium and standard reference pressures.

2. Air static pressure controllers shall have slack diaphragms with standard ranges 0 to 6 inches water column (0 to 1500 Pa) and an adjustable proportional band range of 0.02 to 0.5 inches water column (5 to 125 Pa).

3. Sensing elements for duct applications shall be damped to preclude pulsation.

4. Water differential pressure controllers shall have a minimum range of 0 to 50 psig (0 to 345 kPa) or 0 to 250 psig (0 to 1725 kPa) as required by the application with adjustable proportional band of one to 25 psig (170 kPa). Sensing elements shall be diaphragm type with 3-valve manifold. Provide siphons and pressure snubbers.

2.12 ELECTRIC PRESSURE SWITCHES

A. Type: Provide bourdon tube or diaphragm type electric pressure switches with tamperproof adjustable set point and differential settings. Design switches for 200 percent overpressure and full vacuum underpressure without damage or accuracy impairment.

2.13 DAMPERS

A. Standards: Provide opposed blade and parallel blade factory fabricated dampers of extruded aluminum, galvanized steel or stainless steel with metallic anti-friction non-ferrous bearing in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.

B. Types: Use parallel blade dampers in mixing chambers and plenums. Use opposed blade dampers for volume control, face and bypass dampers, smoke dampers, fan discharge, and variable air volume control.

C. Pressure Rating: For fan systems less than 10-inch water gauge (2490 Pa) static pressure, design and construct dampers to withstand a pressure of 150 pounds per square foot (7.1 kPa) without damage, leakage, flexure, or distortion.

D. Leakage: Maximum air leakage rate for all dampers shall not exceed 10 cubic feet of air per minute per square foot (50 L/s/m^2) at atmospheric pressure when closed against a 4-inch water gauge (1000 Pa) static pressure.

E. Operators: Damper operators shall have sufficient power to open and close the dampers and limit the leakage to the specified rate. Power wiring shall be extended to operator by this contractor.

F. Shafts and Bearings: Provide cadmium plated steel shafts in permanently lubricated bronze sleeve bearings or permanently lubricated ball bearings.

G. Blade Sizes: Reinforced or ribbed blades shall not exceed 8 inches (200 mm) in width nor 48 inches (1200 mm) in length.

1. Flat or unreinforced blades will not be acceptable.

2. Damper sections exceeding 4 feet (1200 mm) in width or 4 feet (1200 mm) in height shall be constructed with multiple frames and linkages.

H. Frames: Construct frames of factory welded galvanized steel hot dipped after construction or bolted extruded aluminum frames.

1. Dampers larger than 8 square feet (.7 m^2) in area shall have corner bracing gussets at each corner welded to the damper frame.

I. Linkages: Provide linkages to uniformly transmit damper operating forces to each damper blade.

1. Construct linkages of galvanized or cadmium plated steel or stainless steel.

2. Bearings and joints shall be ball and socket or sleeve bearings of brass, bronze or stainless steel, with plated bolts and locking nuts.

J. Seals: Provide mechanically attached elastomer or neoprene blade tip seal along the full length of each blade edge and flexible stainless steel seals along damper blade ends where the blades abut the frame. Adhesives or staples will not be acceptable.

K. Damper Mounting: Mount dampers to casings and ductwork in conformance with SMACNA standards. Provide welded or bolted galvanized steel structural supports for dampers larger than 20 square feet (1.9 m^2). Through bolt damper frames to structural supports.

2.14 ELECTRIC ACTUATORS

A. General: Provide electric motor driven actuators (operators) arranged "Fail Safe" in the event of power failure. Unless indicated otherwise, the fail position of each valve shall be the “last position” or “current position” at the time of failure. Design operators to be quiet in operation and function within a range 85 to 100 percent input power potential.

B. Electric Actuators: Provide hydraulic or gear type electric actuators.

1. When operated at rated voltage each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.

2. Provide an end switch to limit travel and design the actuator to continuously stroke without damage.

3. Operators shall function properly within a range of 85 to 120 percent of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.

4. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.

5. Two position actuators shall be of the single direction, spring return or reversing type.

6. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.

7. Reversing and proportioning operators shall have limit switches to limit travel in either direction.

8. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

9. All valve and damper actuators shall be 24 volt. Use of 120 volt actuators will be considered for selective applications such as: large valves (approximately 8-inch and larger), or line voltage control for unit heaters, cabinet heaters, etc. where acceptable to the using agency. In all cases (24 volt and 120 volt), power for valve and damper actuators shall be provided by the ATC contractor.

C. Damper Operator Mounting: Mount damper operators where accessible for maintenance.

1. If located outside the duct or casing, mount operators on a 14 gauge (2.0 mm) reinforced support plate arranged to allow insulation between the support plate and the face of the duct or casing.

2. Brace damper operators rigid to show no deflection or movement over the full range of the damper stroke.

2.15 CONTROL PANELS AND CABINETS

A. Local Panels and Cabinets: Provide local control cabinets for each air handling unit, automatically controlled equipment such as pumps, fans, heaters and convertors, or groups of such equipment in a single mechanical equipment room.

B. Standards: Construct panels in conformance with UL 50, "Cabinets and Boxes," or similar approved construction, with backbox, full-sized piano hinged face, stainless steel lockable latch, and secure to the building construction.

1. Internally mount all controllers, relays, terminal boards, and miscellaneous control devices, on a removable panel.

2. Flush mount in the door all indicators, selector switches, remote setpoint adjusters, and pilot lights.

3. Cabinet internals may be factory or field wired and piped. Wire shall be neat, braced, and strapped flat to present a neat appearance and to easily trace wiring and piping from one device to another.

4. Floor mounted panels shall be bolted to 1-1/2-inch by 1-1/2-inch (40 mm by 40 mm) structural support channel, bolted to the floor and braced at the top.

2.16 SYSTEM DIAGRAMS

A. Mounting: Mount control diagrams adjacent to each local control panel on a furniture steel extension either bolted to wall or to an extension of the control cabinet structural support.

1. Control diagrams shall include system one-line diagram, system control diagram, sequence of operations, and schedule of control devices.

2. Diagrams shall be hermetically sealed in laminated 16 gauge (1.6 mm) plastic.

3. Diagrams shall be permanent, black on white background, not subject to fading when subjected to artificial or natural light. Diazo prints are not acceptable.

4. Diagrams shall represent the current, "as-built" status of the control system, after acceptance by the representative of the Owner.

5. Obsolete, out of date, or field modified diagrams shall be removed, and new current diagrams furnished.

6. Diagrams and devices on local control panels shall be identified with engraved phenolic nameplates, white on black, minimum 1/4-inch (6 mm) high block capital lettering, screwed or bolted to panel or mounting plate face. Adhesive attachments are not acceptable.

2.17 WIRING

A. General: Provide a complete system of electric wiring for temperature control apparatus including control power transformers and wiring to the transformer primary.

B. All wiring shall be installed in conduit. Refer to Division-26 section, “Raceways.” MC cable is prohibited in all locations.

C. Wiring: Wire for low voltage AC shall be minimum 300 volt insulated copper No. 18 AWG or larger conforming to NFPA 70, Type MTW, THHN or TFFN, installed in accordance with Division-26 of these specifications.

1. For low voltage DC and an electronic circuit carrying less than 0.5 amperes, cables of two or more conductors not smaller than No. 18 AWG solid copper or No. 18 AWG solid copper if not shielded may be used in lieu of individual wires.

2. Cables carrying analog signals shall be shielded, if required by the manufacturer.

3. Cables shall be terminated in solder or screw type terminal strips.

4. Cables shall not be tapped at any intermediate points.

5. All wire shall be color coded or numbered for identification. Identify as indicated on shop drawings and "as-built" drawings.

6. Wire terminating in screw type terminal strips shall have pressure connectors conforming to UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," or UL 486B, "Wire Connectors for Use with Aluminum Conductors."

7. Wire terminations without connectors or traveling pressure pads will not be accepted.

D. The contractor shall in no case combine control wiring (line or low voltage) with power wiring in the same conduit.

2.18 ACCESSORIES

A. Provide a PC based operator's workstation within the building at a location determined by the owner, including a flat screen monitor (minimum 21") and a color laser printer. Provide color graphics of all systems to be controlled, monitored and alarmed by the EMCS. Computer hardware and software shall be compatible with the most current version of the ATC vendor's software and graphics packages.

B. Provide a portable operating terminal for connection to the main DDC control panel. In addition, main panel shall be provided with modem connection.

2.19 FLOW SENSORS

A. General: Provide sensors for measuring flow in piping and ductwork that are compatible with static pressure and differential pressure analog of the electronic controllers served.

B. Turndown: Provide sensors with an output characteristic which gives a continuous mathematical function over the full range of flow from maximum to minimum required.

C. See specifications, this section, for required air and/or water flow monitor measurement characteristics.

D. Provide all necessary power and control wiring as required for complete and operational flow measurement systems interlocked with the building EMCS.

2.20 AIRFLOW MEASUREMENT SYSTEMS (AIRFLOW MONITORS)

A. The airflow measurement system (AFMS), including airflow monitor, sensors, controllers, transmitters, etc., indicated on the plans shall be capable of continuously monitoring airflow rates at each measurement location. The system shall consist of one or more airflow measuring devices and a single microprocessor based transmitter. The number of sensing points shall be as per manufacturer's recommendation for the specified application. The AFMS shall not require recalibration or adjustment over the life of the equipment. If the technology provided is vortex shedding or the pitot tube type the system shall be calibrated on a semi-annual basis during the construction phase through the end of the warranty. The manufacturer is responsible for all cost associated with recalibration.

B. Upon request, the manufacturer shall provide for approval and verification a written copy of the following:

1. 16 point NIST traceable report of calibration used for the reference standard.

2. UL/cUL 873 report listing the AFMS as a complete assembly.

3. Independent laboratory test report results of 100% survival rate in a 30 day saltwater and acid vapor test.

C. The AFMS shall produce a single, linear, analog output signal for airflow, which can be measured by the host control system. The system shall have the ability to perform self-diagnostics and automatic zeroing to adjust the signal to zero at pre-

determined time intervals, which eliminates all output signal drift due to thermal, electronic and mechanical effects. In the event of sensor failure, the system shall ignore the failed sensor(s), average the remaining sensors and continue to operate.

D. The total accuracy from the airflow measurement to the host controls, including sensing point averaging error, the sum of the sensor and electronic (transmitter) errors, etc. shall not exceed +/-2% of reading at both minimum and maximum airflow rates based on the manufacturer's published performance specifications for all devices. In addition, total system performance including sampling error, shall not exceed +/-5% of actual airflow. The installed accuracy, in accordance with manufacturer's recommendations, without field adjustment shall be as follows throughout the operating range:

1. Ducts and plenums: +/- 3% of reading

2. Outside air intakes: +/-5% of reading

3. Fan inlets: +/- 10% of reading

E. The sensors and electronics shall operate over a temperature range of -20 to 120°F for ducted supply or return applications and -20 to 120°F for outside air applications. The sensors and electronics shall operate at a relative humidity range of 0 to 95% (non-condensing) for ducted supply and return applications and 0-99% (non-condensing) for outside air applications. Each sensor node shall be individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard and have an accuracy of $\pm$2% of reading over the entire calibrated airflow range of 0 to 5,000 FPM for ducted applications. Upon request, a working demos shall be provided to the design team to display that the system can work at low flows.

F. For standard applications, sensors shall be constructed of materials that resist corrosion due to moisture or salt in the airstream. Aluminum probes shall be provided. For laboratory exhaust applications, provide stainless steel sensors with stainless steel casing. Each sensor probe shall be provided with an integral, FEP jacket, plenum rated CMP/2CL2P, UL/cUL listed cable rated for exposures from -67°F to 392°F (-55°C to 200°C) and continuous and direct UV exposure. Plenum rated PVC jacket cables are not acceptable. Devices that have electronic signal processing components on or in the sensor probe are not acceptable. Where the electronics are installed in a location exposed to potential wind driven rain or snow (including outside air plenum) provide a NEMA 4 enclosure for all electronics. In addition, a visual display shall be provided to illustrate airflow (CFM) and temperature. The transmitter must also be able to display individual sensor reading and each individual flow for each fan on a fan array.

G. Analog signal capability shall include two output terminals: the first (AO1), shall provide the total airflow rate; while the second output (AO2) shall be field configurable to provide one of the following: temperature, low and/or high airflow user-defined set point alarm, individual fan alarm (for fan arrays) or system status alarm.

H. Airflow measuring devices shall be UL listed as an entire assembly. The transmitter shall include fused protection.

I. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans for conformance with installed accuracy requirements. A written report shall be submitted to the consulting mechanical engineer if any measurement locations will not result in specified installed accuracy requirements.

J. Prior to purchase or installation of the air flow monitor (AFM), the Contractor and/or AFM Product Representative shall review each equipment and/or duct mounted location to verify suitability for installation. Should there be any discrepancy regarding installation or performance, the Contractor shall notify the Engineer immediately.

K. Provide all necessary power and control wiring as required for a complete and operational air flow measurement system interlocked with the building EMCS. Network communications RS 485 (BACnet MS/TP or Modbus RTU) or Ethernet (BACnet Ethernet or BACnet IP, Modbus TCP and TCP/IP) shall provide: the average airflow rate, temperature, high and/or low airflow set point alarm, system status alarm, individual sensor node airflow rates (individual fan airflow rates for fan arrays) and individual sensor node temperatures. Individual node airflow rates and temperatures shall be available via the network with Lon.

L. Airflow measurement system manufacturers shall be limited to the following:

1. Ebtron (Gold)

2. Air Monitor Valo-probe with Veltron II transmitter

3. Tek Aire Vortek VT-5000

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring and Conduit: Provide wiring and conduit to connect the automatic control system components for an operational system.

1. Provide wiring in accordance with requirements indicated in this section.

2. Run conduit in straight lines, parallel to the lines of the building, and rack on factory furnished mounting blocks attached to the building structure. Where run buried in slabs provide long sweep rigid conduit bends extending 6 inches (150 mm) above the slab at slab penetrations.

3. Do not bury or conceal wiring beneath building insulation.

4. Locate wiring clear of access doors, accessible ceilings, lighting fixtures, walkways, or any location subject to damage or abrasion.

B. Identification: Label or code each field wire at each end, and each controller and controlled device.

1. Identification shall be permanent, robust, not subject to fading, and flameproof.

2. Permanently mark terminal blocks at wire termination points.

3. Identify each control device with an engraved laminated phenolic nameplate, white on black, lettering not less than 1/8-inch (3 mm) height, on 1-1/2-inch (40 mm) by 1-inch (25 mm) tag and brass interlocked chain secured to the control device. Name shall correspond with identification on the shop drawings.

4. Identify sensors, controllers, relays, either mounted in local or central control panels, or remote mounted with a similar name tag as specified above. Attach to or adjacent to controllers with stainless steel or brass screws or rivets. Adhesives will not be acceptable. Do not attach to removable controller covers.

C. Valves: Install valves in piping with stems as vertical as possible but in no case less than 45 degrees from vertical. For soldered or welded connections, remove valve internals before mounting.

D. Electric Valves: Wire electric valves in accordance with NFPA 70 with not less than 2 feet (610 mm) of flexible liquidtight connector with watertight bushings at the valve actuator. Brace conduit to the building structure.

E. Pressure and Temperature Sensors: Install pressure and temperature sensors as follows.

1. Locate pressure and temperature sensing points sufficiently downstream from the control device to increase control loop time constant and minimize hunting.

2. Locate shut-off valves and 3-valve bypasses as specified in "Sensors" paragraph of this Section.

3. Locate sensors where accessible for maintenance and replacement.

4. Do not cover or conceal sensors with insulation.

F. Space Sensors: Install space sensors as follows.

1. Space sensor including space thermostats, aspirating thermostats, humidistats, pressure or differential pressure sensors shall be enclosed in cast brushed aluminum or 16 gauge (1.6 mm) brushed and ground stainless steel enclosures. Enclosures shall be tamperproof. Setpoint adjustment or settings shall not be visible or adjustable from outside sensor enclosure. Sensors shall be securely mounted and rigid.

2. Locate room thermostats and other room sensors approximately 48 inches (1200 mm) above the floor (or otherwise as required to meet the most current ADA guidelines) on inside wall where they will respond to average conditions in the space.

3. Sensors mounted on outside walls, if unavoidable, shall be mounted on factory made insulated brushed stainless steel bases.

4. Provide thermostat/sensor guards in all areas subject to potential damage. Thermostat/sensor guards shall be clear, impact resistant lockable plastic or approved equivalent. Thermostat/sensor guards shall be provided in the following areas and other similar type spaces subject to potential damage: gymnasium, multi-purpose rooms, fitness areas, activity rooms, mechanical rooms, electrical rooms, etc.

G. Air Handling Unit Temperature Indicators: For each factory assembled central station air handling unit and field erected air handling unit, provide temperature indicators in the following locations. In addition, unless indicated otherwise by the Owner, provide thermostat/sensor guards wherever students have access, including but not limited to: classrooms, corridors, cafeteria, media center, auditorium, etc.

1. Each outside air plenum.

2. Each return air plenum.

3. Each cooling coil inlet and discharge.

4. Each heating coil discharge.

5. Temperature indicators shall be so located that they may be read by an operator standing on the operator floor. Indicators more than 8 feet (2400 mm) above the floor shall be remote bulb type.

H. Duct Sensors: Select duct sensor locations to properly sense average air conditions, minimize vibration, avoid dead air spaces, and within velocity limits required by the manufacturer.

1. Provide velocity shields where required.

2. Securely mount or clamp averaging elements, maximum 3 feet (900 mm) on centers to the leaving side of coils and equipment. Insulate averaging elements from equipment and protect from vibration.

3. Provide separate duct flanges for each sensing device.

4. Provide gaskets or sealant where elements penetrate duct walls.

5. Mount sensor to allow easy removal and servicing without disturbing insulation or vapor barrier. Mount on standoff brackets to avoid condensation.

6. Coordinate the location for duct access doors downstream from each duct sensor.

I. The ATC contractor shall interface with smoke detectors, smoke dampers and fire alarm devices as required to accomplish equipment shutdown, alarms, etc., as indicated in sequences.

J. For single phase motors, provide relays and/or contactors of appropriate horsepower and voltage rating as required to energize/de-energize equipment as indicated in sequences.

3.2 TEST PLAN

A. Test Plan: Prepare a written test plan indicating in a step-by-step, logical fashion, the procedures by which the automatic control system will be tested, adjusted, and checked.

B. Pre-Approval: Not less than six (6) weeks prior to testing, provide four (4) copies of the proposed test plan for approval. Meet and discuss the test plan, and make agreed changes to the written plan.

C. Content: Plan shall include, as a minimum, for each system and sub-system of the automatic control work the following:

1. System name.

2. List of devices with brief description of functional purpose of each.

3. A description of the expected signal values transmitted by the sensor.

4. A description of the expected signal values transmitted by the controller to the control device or actuator.

5. A description of the expected values of the control medium from limit-to-limit.

6. A description of the instrumentation required to test the system.

7. A description of the expected field adjustments for transmitter, controller, and control actuator should control parameters fall outside of expected values.

8. A log sheet or sheets on which expected and field read values will be recorded and final field read values indicating that the system is operating in accordance with contract requirements.

3.3 TESTS DURING AND AFTER INSTALLATION

A. Instrumentation and Control: Calibration test each controller as follows:

1. Disconnect the sensor input signal to the controller and provide a compatible test signal generator.

2. Simulate expected transmitter values and input to the controller. Record controller branch line values.

3. Examine control device and determine that the device is responding.

4. Simulate maximum and minimum transmitter signal values and verify minimum and maximum controller output values and control device minimum and maximum stroke range.

5. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedule, proportional relationship, reset relationship, and derivative reaction.

6. When the controller and control device portion of each loop are responding as designed, reconnect the sensor transmitter input line.

7. After mechanical equipment control becomes operational, perform an operational test of each control loop recording sensor, transmitter, controller input, controller output and control medium parameter.

8. Entire test shall be witnessed by an owner's representative.

9. Upon satisfactory test a copy of final test results shall be bound in the operating and maintenance manual.

3.4 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the Contractor shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A calibration verification report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each and every control sequence indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of this section. This form (electronic version is available upon request) shall be completed for all mechanical equipment provided under this contract. This shall include, but not be limited to each air handling unit, fan, pump, VAV terminal, fan coil unit, unit ventilator, DX cooling equipment, miscellaneous heating equipment, etc.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all systems are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The mechanical systems shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.5 DEMONSTRATION AND TRAINING

A. Demonstration: After completion of testing as hereinbefore specified, provide demonstration and training of designated operating personnel (refer to Division-1).

1. Demonstration shall be performed.

2. Demonstration shall include the operation of the entire mechanical system under the control of the Contractor and shall include the start-up, operation, and shutdown of the system in accordance with the sequence of operation.

3. The operation of each device shall be performed in accordance with the written instructions contained in the operation and maintenance manual, a copy of which shall be available ten (10) working days prior to the test. No deviation from procedures in the operating manual will be permitted.

B. Failure to Perform: Should the system fail to perform in accordance with the requirements of the operation and maintenance manual, the system shall be repaired, recalibrated, retested as necessary, and a second demonstration performed.

1. Subsequent demonstrations shall occur until the automatic control system and all associated mechanical and electrical equipment are operating in accordance with contract requirements.

2. All testing, retesting, and recalibration shall be at no additional expense. The Contractor shall reimburse the expenses of the commissioning team for each test after the first.

3.6 INSTRUCTING OPERATING PERSONNEL

A. Instructors and Superintendent: Upon completion of the work and acceptance by the representative of the Owner, provide the services of an Instructor, who together with the superintendent specialist shall instruct designated operating personnel in the operation and maintenance of the automatic control system.

1. The services of the Instructor shall be available for not less than four 4-hour days of instruction.

2. The services of the superintendent specialist shall be available for not less than two 4-hour days.

3. Instructions shall be based upon the use of the operating and maintenance manual together with copies of the laminated control diagrams affixed adjacent to each local control panel.

4. Training and instruction will be witnessed. The witness shall monitor the entire training program and prepare a written report on the competency and effectiveness of instructors and the level of expertise of designated operators. A report will be submitted recommending additional training at additional cost, if such is deemed necessary.

3.7 BUILDING MANAGEMENT AND CONTROL SYSTEM DEVICES AND POINTS

A. Provide all building management and ATC system controllers, devices, points, etc. as required to accomplish the control sequences and equipment functions indicated throughout the contract documents, including drawings and specifications. In addition, provide all controllers, devices, points, etc. as required to control, operate, monitor and alarm all equipment and devices indicated on the contract documents (including but not limited to: pumps, air handling units, fans, variable frequency drives, air volume terminal units, humidifiers, valves, dampers, flow measuring devices, sensors, carbon monoxide (CO) detection devices, etc.). All points shall be available through the Energy Management Control System (EMCS). See attached points list (where applicable).

B. Building management and control points shall include status for all mechanical equipment with equipment failures alarmed at the EMCS. In addition, furnish and install all points required to provide complete, color, system graphics of all mechanical systems and components indicated throughout the contract documents. All equipment and devices indicated throughout the contract documents shall be indicated at the operator's workstation (where applicable) and all end devices shall be individually controlled unless specifically indicated otherwise.

C. Building management and control system features for equipment and devices shall include, but not be limited to, the following where applicable: runtime, trend data, optimal start, scheduling, paging, system graphics, and internet access to graphic and text-based displays.

END OF SECTION 230900

bkm

FUNCTIONAL PERFORMANCE TEST VERIFICATION FORM

Project Name: _____

FUNCTIONAL VERIFICATION FOR: _____(Insert Equipment Name, i.e. AHU, Fan, Pump, VAV, etc.)					
	SEQUENCE OF OPERATION	Controlling as Specified (Y/N)	ATC Technician Initials	Date	Notes
	(Insert complete sequence of operation as indicated in approved ATC submittal)				
	Example: Air Handling Unit Control				
	1. General:				
	1.1 Supply and return fans shall be interlocked. Fans shall operate continuously in the occupied mode. HOA switch shall be in the AUTO position.				
	1.2 Occupied-Unoccupied shall be as determined by the EMCS.				
	2. Temperature Control:				
	2.1 Occupied				
	A. When the outside air enthalpy is above the return air enthalpy, D-1, D-2 and D-3 shall modulate as follows:				

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SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of refrigerant piping work is indicated by requirements of this section and all other Division-23 sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Specialist with at least five (5) years of successful installation experience on projects with refrigerant piping work similar to that required for project.

C. Codes and Standards:

1. ASME Compliance: Fabricate and install refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig (100 kPa).

2. IMC Compliance: Fabricate and install refrigerant piping in accordance with “International Mechanical Code".

3. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.

B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ASME B31.5).

C. Shop Drawings: Submit scaled layout drawings of refrigerant pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

D. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. General: Provide identification complying with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment", in accordance with the following listing:

1. Refrigerant Piping: Plastic pipe markers.

2.3 BASIC PIPES AND PIPE FITTINGS

A. General: Provide pipes and pipe fittings complying with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", in accordance with the following listing:

1. Tube Size 4-1/8" (105 mm) and Smaller: Copper tube; Type ACR, hard drawn temper; wrought-copper fittings; brazed joints.

2. Tube Size 1/2" (13 mm) and Smaller: Copper tube; Type ACR, soft annealed temper; wrought-copper fittings, brazed joints.

3. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-5 for brazing filler metal.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems", in accordance with the following listing:

1. Pipe escutcheons

2. Drip pans

3. Sleeves

4. Sleeve seals

2.5 BASIC HANGERS AND SUPPORTS

A. General: Provide hangers and supports complying with Division-23 sections "Basic HVAC Materials and Methods" and Hangers and Supports for HVAC Piping and Equipment", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.

2. Two-bolt riser clamps for vertical piping supports.

3. Concrete inserts, C-clamps, and steel brackets for building attachments.

4. Protection shields for insulated piping support in hangers.

5. Copper flashings for piping penetrations.

2.6 SPECIAL REFRIGERANT VALVES

A. General: Special valves required for refrigerant piping include the following types:

1. Globe and Check Valves:

a. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F (149°C) temperature rating, 500 psi (3450 kPa) working pressure.

b. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, 500 psi (3450 kPa) working pressure.

2. Solenoid Valves:

a. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, 1/2" (13 mm) conduit adapter, 250°F (121°C) temperature rating, 400 psi (2720 kPa) working pressure.

1) Manual Operator: Provide manual operator to open valve.

3. Ball Valves:

a. Ball Valve with Access Port: Compatible with all CFC, HCFC and HFC refrigerants and oils, designed for pressures up to 775 psig, and temperature range of -40°F (-40°C) to 300°F (149°C), full port construction to match line size ID, internally equalized ball design, rupture-proof encapsulated stem, UL listed.

1) Confirm compatibility with selected VRF/equipment manufacturer.

2.7 REFRIGERANT SPECIALTIES

A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel, screen, 100 mesh, UL-listed, 350 psi (2380 kPa) working pressure.

B. Moisture-Liquid Indicators: Forged brass, single port, removable polished optical glass, solder connections, UL-listed, 200°F (93°C) temperature rating, 500 psi (3450 kPa) working pressure.

C. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL-listed, 500 psi (3450 kPa) working pressure.

D. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi (3450 kPa) working pressure.

E. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.

F. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.

2.8 BASIC VIBRATION CONTROL

A. General: Provide vibration control products complying with Division-23 sections" Basic HVAC Materials and Methods" and "Vibration Isolation for HVAC Piping and Equipment", in accordance with the following listing:

1. Isolation hangers

2. Riser isolators

3. Riser support isolators

4. Flexible pipe connectors

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Identification for HVAC Piping and Equipment".

3.3 INSTALLATION OF REFRIGERANT PIPING

A. General: Install refrigerant piping in accordance with Division-23 sections "Basic HVAC Materials and Methods" and "Pipe, Tube and Fittings for HVAC Systems", and in compliance with equipment manufacturer's recommendations.

B. Install refrigerant piping with 1/4" per foot (6 mm per meter) (1%) downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.

C. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

D. Bleed dry nitrogen through refrigerant piping during brazing operations.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Piping Specialties for HVAC Systems".

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Install supports and anchors in accordance with requirements of Division-23 sections "Basic HVAC Materials and Methods" and "Hangers and Supports for HVAC Piping and Equipment".

3.6 INSTALLATION OF SPECIAL REFRIGERANT VALVES

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing, replace after joints are completed.

1. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.

a. Wiring of solenoid valves is specified in applicable Division-26 sections, and is included as work of this section.

3.7 INSTALLATION OF REFRIGERANT ACCESSORIES

A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for service.

B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, in accessible location.

C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated, and in accessible location for service.

D. Evaporator Pressure Regulators: Install in refrigerant suction lines or evaporator outlets as indicated. Adjust, if required, for proper evaporator pressure.

E. Refrigerant Discharge Line Mufflers: Install as indicated, in horizontal or downflow portion of hot-gas lines, immediately after leaving compressor; not in riser.

3.8 EQUIPMENT CONNECTIONS

A. General: Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.9 FIELD QUALITY CONTROL

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ASME B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Refrigerant piping shall be pressure tested and evacuated in accordance with the system manufacturer’s recommendations, and /or as follows (whichever is more stringent):

1. Pressure Test (Air Tight Test): Pressurize the suction gas pipe, high/low pressure gas pipe and liquid pipe with dry nitrogen to a minimum pressure as per the system manufacturer. Pressure test duration shall be a minimum of 24 hours. If the pressure does not drop within the 24 hour period, the system passes. If there is a drop in pressure, check for leaks, make repairs and re-test as prescribed above.

2. Evacuation Test (Vacuum Drying): Evacuate the system from the suction gas pipe, high/low pressure gas pipe and liquid pipe to a minimum vacuum pressure as per the system manufacturer. Vacuum pressure shall be maintained in accordance with manufacturer’s minimum duration recommended. If it rises, the system may either contain moisture or have leaks, if so, make repairs and re-test as prescribed above.

3. Refer to the Refrigerant Leakage Test Summary Form to document test results. No other form will be acceptable. Submit results for all systems for review.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

C. Refer to Division-23 section “Testing, Adjusting and Balancing” for additional specific test criteria and test form to be completed.

3.10 DEHYDRATION AND CHARGING SYSTEM

A. Install core in filter dryer after leak test but before evacuation.

B. Evacuate refrigerant system with vacuum pump, until temperature of 35°F (2°C) is indicated on vacuum dehydration indicator.

C. During evacuation, apply heat to pockets, elbows, and low spots in piping.

D. Maintain vacuum on system for minimum of five (5) hours after closing valve between vacuum pump and system.

E. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi (14 kPa).

F. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.11 ADJUSTING AND CLEANING

A. Cleaning and Inspecting: Clean and inspect refrigerant piping systems in accordance with requirements of Division-23 section "Pipe, Tube and Fittings for HVAC Systems".

END OF SECTION 23 23 00

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SECTION 23 31 13 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of low pressure ductwork is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections. Low pressure duct systems shall be defined as those duct systems which have an external static pressure (E.S.P.) of less than two-inches (2") water gauge (wg) (500 Pa). See schedules on drawings for external static pressure information.

B. Types of low pressure ductwork which may be required for this project include the following:

1. Return air ductwork

2. Outdoor air ductwork (conditioned or unconditioned)

3. Exhaust ductwork

4. Supply air ductwork (downstream of air terminal units or systems without air terminal units)

5. Air transfer ductwork

C. Pressure Classification:

1. All ductwork provided under this section shall be “Duct Pressure Class 2” as defined by SMACNA Standards.

1.2 QUALITY ASSURANCE

A. Installer: A firm with a minimum of five (5) years of successful installation experience on projects with low pressure ductwork systems similar to that required for project.

B. SMACNA Standards: Comply with latest edition of SMACNA Standards for fabrication, storage and installation of low pressure ductwork. In addition, all new ductwork shall comply with SMACNA’s “Duct Cleanliness for New Construction Guidelines.” The “Duct Cleanliness Level” for all ductwork shall meet the requirements of the “Advanced Level.”

C. ASHRAE Standards: Comply with ASHRAE Standards for fabrication and installation of low pressure ductwork.

D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems."

E. Field Reference Manual: Have available at project field office, copy of SMACNA Standards - latest edition.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products used for work of this section.

B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure as required by Division-23 Section, “Basic HVAC Requirements”. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. All ductwork shall be shipped to the site with covered ends. The ductwork shall be covered with 3-mil (minimum) shrink wrap, with a minimum 2-inch overlap on all sides, to provide a water-tight seal at each opening. The covered ends shall remain intact until installation.

C. Store ductwork, accessories and purchased products inside and protect from weather.

D. Ductwork fittings and accessories stored on site for installation shall be covered with protective tarps and elevated a minimum of four inches until installed.

E. Provide periodic (weekly) photographs of the jobsite storage to document that the ductwork is stored in accordance with the criteria outlined in this specification section.

F. Lined ductwork not stored in accordance with the above criteria shall be replaced in its entirety. Unlined ductwork not stored in accordance with the above criteria shall be cleaned and inspected by the Owner’s representative prior to installation. Contractor shall clean unlined ductwork to the satisfaction of the Owner, or replace at the Owner’s discretion.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other

imperfections, including those which would impair painting. Provide interior lining or double wall duct as indicated on the drawings and/or these specifications.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating.

C. Stainless Steel Sheet: Where indicated (S/S), provide stainless steel complying with ANSI/ASTM A 167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated (Al-), provide aluminum complying with ANSI/ASTM B 209, Alloy 3003, Temper H14.

E. Copper Sheet: Where indicated (Cp-), provide copper complying with ANSI/ASTM B 370 cold-rolled, except where soft temper required for unusual forming.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated. Provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Liner: Minimum one inch (25 mm) thick (unless otherwise noted) fiberglass, minimum R-value of 4.2 (k-value 0.24 or better), complying with ASTM C 1071, ASTM G 21, ASTM G 22, NFPA 90A, NFPA 90B and UL 181. Duct lining shall contain an EPA registered antimicrobial agent which resists the growth of bacteria and fungi as proven by tests in accordance with ASTM G21 and G22. Liner noise reduction coefficient (NRC) shall be 0.70 or better. Surface of liner shall have water repellent properties. Duct liner shall be Johns Manville Linacoustic RC or equivalent by Certainteed, Knauf or Owens Corning.

C. Duct Liner Adhesive: Comply with Adhesive and Sealant Council, Inc. (ASC) and ASTM C916.

D. Duct Liner Fasteners: Comply with SMACNA Standards. Fasteners shall not compress liner by more than 1/8".

E. Duct Sealant: Non-hardening, non-migrating, oil based mastic or liquid elastic sealant (type applicable for fabrication and installation) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be solvent (oil) based, water based or silicone based as follows:

1. Solvent (oil) based sealant shall be used for indoor applications on all new construction installations. In addition, for indoor renovation projects, solvent (oil) based sealant shall be included in the contractor’s bid and utilized wherever the sealant odor is not objectionable to the owner. Contractor shall coordinate with the owner’s representative prior to the duct installation.

2. Water based sealant shall be utilized for indoor renovation applications where the odor from solvent (oil) based sealant is objectionable to the owner. Contractor shall coordinate with the owner’s representative prior to the duct installation.

3. Silicone based solvent shall be utilized for all outdoor duct installation applications.

4. Regardless of duct sealant type, maximum duct leakage requirements outlined in these Division-23 specifications shall be maintained.

F. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

G. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" (6 mm) diameter or 3/16" (4.8 mm) thickness may be plain (not galvanized).

2.3 FABRICATION

A. Shop fabricate ductwork in 4 (1200 mm), 8 (2400 mm), 10 (3000 mm) or 12-foot (3600 mm) lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA Standards - latest edition.

C. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Standards.

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to one and one-half times the associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

E. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

F. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

G. Low pressure rectangular ductwork, fittings, etc., shall be constructed, installed and supported in accordance with current SMACNA Standards of gauges not less than the following:

Maximum Side	Minimum Gauge
Up to 12" (Up to 300 mm)	26 (.5 mm)
13" to 30" (325 mm to 750 mm)	24 (.7 mm)
31" to 60" (775 mm to 1500 mm)	22 (.8 mm)

61" to 84" (1525 mm to 2100 mm)	20 (1.0 mm)
Over 84" (Over 2100 mm)	18 (1.3 mm)

H. All factory or shop fabricated ductwork shall be constructed as required to meet the testing requirements indicated in this section and Division-23 section "Testing, Adjusting and Balancing."

2.4 SPIRAL DUCTWORK

A. Spiral duct shall have locked seams equivalent to United McGill "Uni-Seal," so made as to eliminate any leakage under the pressures for which this system has been designed. Spiral duct shall be manufactured of galvanized steel meeting ASTM A-527 by the spiral lockseam method and in the minimum gauges listed:

Diameter	Minimum Gauge
3" thru 26" (75 mm thru 650 mm)	26 (.5 mm)
28" thru 36" (700 mm thru 900 mm)	24 (.7 mm)
38" thru 50” (950 mm thru 1250)	22 (0.8 mm)
52" thru 60” (1300 mm thru 1500)	20 (1.8 mm)
62” and larger (1550 mm and larger)	18 (1.2 mm)

1. All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections. Fittings and couplings shall be of the following minimum gauges:

Diameter	Minimum Gauge
3" thru 26" (75 mm thru 650 mm)	24 (.7 mm)
28" thru 36" (675 mm thru 900 mm)	22 (1.0 mm)
38" thru 50” (950 mm thru 1250)	20 (1.0 mm)
52" thru 60” (1300 mm thru 1500)	18 (1.2 mm)
62” and larger (1550 mm and larger)	16 (1.4 mm)

2. Branch fittings supplying linear bar diffusers shall be "lo-loss" conical type saddle taps.

3. All 90 degree tees and 45 degree laterals, either full size or reducing, shall be conical pattern for 90 degree and straight pattern for 45 degree laterals, produced by machine or press forming. The entrance shall be free of weld build-up, burrs or irregularities. Provide tangential tees where required.

4. Elbows in diameters 3" (75 mm) through 12" (300 mm) shall be two section die-stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1.5 times the cross section diameter. All elbows not die-stamped shall be fabricated according to the following schedule:

Elbow Angle	Number of Gores
Less than 45˚	2
46˚ thru 60˚	2
Over 61˚	3

5. The reduction of divided flow fittings shall be conical spun section in the thirty-six reductions in sizes 4" (100 mm) through 22" (550 mm).

6. Spun bellmouth connections shall be used at each round take-off from the high pressure plenum.

7. Offset fittings shall be constructed so that length of offset is not less than two (2) duct diameters.

8. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint, minimum two (2) coats.

9. Supports and sealants shall conform to applicable portions of SMACNA.

10. Flexible ductwork shall be as previously specified for low pressure duct systems.

2.5 FLEXIBLE DUCTWORK

A. General: Provide insulated flexible ductwork where indicated on drawings, as manufactured by Flex Master Type 6B, or equivalent. Flexible ductwork shall be in compliance with UL-181 Class 1 Air Duct, fabricated with an acoustically transparent nylon inner fabric.

1. Liner: Nylon fabric, mechanically locked without adhesives.

2. Helix: Corrosion resistant galvanized steel; formed and mechanically locked to fabric.

3. Vapor Barrier: Black fire retardant, polyethylene.

4. Insulation: 1” thick. R-value of 6.0.

5. Pressure Rating: 6” wg positive.

Sound Attenuation: Flexible ductwork shall have minimum sound attenuating capabilities as indicated below for nominal three feet of straight duct:

Duct Diameter	Insertion Loss (db)					
	125 (2)	250 (3)	500 (4)	1000 (5)	2000 (6)	4000 (7)
6	9	10	11	12	12	12
8	9	9	10	10	12	12
10	9	9	9	10	11	10
12	9	8	8	9	11	8

2.6 FRESH AIR INTAKE PLENUMS

A. Fresh air intake plenums shall be double wall construction (minimum 18 gauge exterior wall, 20 gauge interior wall) with 2" (50 mm) thick, three pound density insulation.

2.7 OUTDOOR DUCTWORK

A. All outdoor ductwork shall be double walled duct with 2” flexible elastomeric liner. In addition, duct shall be provided with an outdoor duct insulation system (see Division-23 section “HVAC Insulation” of these specifications) suitable for outdoor applications and U/V exposure. Provide aluminum saddles between duct insulation and duct supports to protect insulation. Contractor shall fasten ductwork to equipment supports as required to withstand windloading. Design of fastening system to withstand windloading shall be approved by a registered structural engineer.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. General: Assemble, install, support and seal ductwork in accordance with recognized industry practices which will achieve air tight (not to exceed 1% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" (3 mm) misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Seal ductwork to SMACNA Standard Seal Class "A" and provide additional sealant as required to meet duct test requirements of this section.

C. Install concrete inserts as required, for support of ductwork in coordination with formwork, as required to avoid delays in work.

D. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" (13 mm) where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" (25 mm) clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

F. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct. Overlap opening on four (4) sides by at least 1-1/2" (40 mm).

H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

I. Support ductwork in manner complying with SMACNA Standards - latest edition of hangers and supports section.

J. Unless indicated otherwise, all stainless steel ductwork shall be welded.

K. Where vapors will be exhausted (dishwasher, cart wash, tunnel wash, canopy hood over sterilizers, etc.), ductwork shall be sloped back toward the source of moisture.

L. All exposed ductwork (in non-mechanical rooms) shall be primed and painted with paint appropriate for sheet metal surfaces. See architectural section "Painting".

M. Provide gasketed duct access doors as required to provide maintainable access to the upstream side of coils, humidifiers, etc.

3.2 INSTALLATION OF LINED DUCTWORK

A. Provide lined ductwork at the following locations, and as otherwise indicated:

1. All ductwork (supply, return, conditioned outside air, DOAS/ERU exhaust return) within the Mechanical Room.

2. All ductwork within 25 feet upstream and downstream of air handling equipment (in all directions, including all duct branches and mains within 25 feet of equipment), including return air fans, with the exception of unconditioned outdoor air intake ductwork.

3. Supply air ductwork downstream of air terminals.

4. All air transfer ductwork, unless otherwise indicated.

B. Dimensions on drawings indicate inside clear dimensions.

C. Fiberglass liner exposed to the air stream shall not be utilized for outdoor air intake ductwork.

D. Where ductwork is exposed to view in occupied areas, rectangular ductwork shall be lined and round ductwork shall be double wall duct with internal lining, unless otherwise noted.

3.3 INSTALLATION OF FLEXIBLE DUCTWORK

A. Where indicated, provide factory insulated flexible ductwork between low pressure supply ductwork and round inlet ceiling diffusers. Provide side take-off fitting with damper (Flexmaster USA, model STOD or equivalent) between the flexible duct and the low

pressure supply ductwork. Extend rigid sheet metal ductwork between the fitting and the flexible ductwork as required. The maximum length of flexible duct shall be 3'- 0" (915 mm).

B. Connections to round neck diffusers shall include a rigid 45 degree sheet metal elbow at the diffuser inlet.

3.4 CLEANING AND PROTECTION

A. Prior to installation, thoroughly clean ductwork internally of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or might interfere with painting or cause paint deterioration.

B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, install sheet metal temporary closures which will prevent entrance of dust and debris until the time all connections are to be completed.

C. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.5 DUCT TESTING

A. Prior to the balancing of systems by the AABC certified balancing contractor, all low pressure ductwork shall be tested by the mechanical contractor for duct leakage. Duct leakage shall not exceed 1%. In addition, current SMACNA and AABC Standards shall apply, where applicable, to meet the maximum 1% leakage. Duct leakage shall not exceed 1% of design cfm for a duration of ten (10) minutes. Test pressures shall be not less than the following:

1. Ductwork systems less than 2.0 in. wg E.S.P.: Test to 2 in. wg

B. Insulation materials shall not be applied until systems have been witnessed, documented, and submitted to meet the above testing requirements.

C. The balance contractor shall witness and certify all duct pressure tests.

D. Contractor shall submit duct leakage test results to the A/E within 72 hours of completed tests. Only test results that meet the specified leakage requirements shall be submitted. Duct test results shall be recorded on the "Air Duct Leakage Test Summary Form" located at the end of Section 230593; no other forms will be accepted. In addition, the duct leakage submittals shall include 11x17 drawing(s) as required to clearly indicate the full extent of the duct test section (each duct test section shall be numbered and color coded).

E. All duct leakage test results shall be included with the final TAB report and the O&M Manual. The orifice tube calibration chart shall also be included with the final duct leakage test report information.

3.6 BALANCING

A. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of low pressure ductwork; not work of this section.

END OF SECTION 23 31 13

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section and all other Division-23 sections.

B. Types of ductwork accessories required for project include the following:

1. Dampers:
    a. Low pressure manual dampers
    b. Control dampers
    c. Counterbalanced dampers
2. Fire and smoke dampers
3. Turning vanes
4. Duct hardware
5. Duct access doors
6. Flexible connections
7. Penetration seals
8. Sound attenuators

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of latest edition of SMACNA Standards. In addition, all duct accessories shall comply with SMACNA's "Duct Cleanliness for New Construction Guidelines." The "Duct Cleanliness Level" for all ductwork shall meet the requirements of the "Advanced Level."
2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
3. UL Compliance: Construct, test, and label fire, smoke and combination fire/smoke dampers in accordance with UL Standards 555 and 555S.

4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, materials of construction and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual.

D. Duct cleaning contractor shall submit proposed approach, methodology and detailed cleaning and sanitizing process for each system listed above for approval prior to work being performed. In addition, provide documentation of NADCA certification, as well as five (5) years of successful performance.

PART 2 - PRODUCTS

2.1 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with the latest edition of SMACNA Standards. Provide damper extender rods as required to compensate for external duct insulation. Air pressure drop shall not exceed 0.10” at 1500 FPM.

B. Control Dampers: Refer to Division-23 section "Automatic Control Systems" for control dampers; not work of this section.

C. Counterbalanced Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-gauge (1.6 mm) aluminum. Provide 1/2" (13 mm) diameter ball bearings, 1/2" (13 mm) diameter steel axles spaced on 9" (230 mm) centers. Construct frame of 2" x 1/2" x 1/8" ((50 mm x 13 mm x 3 mm) steel channel for face areas 25 sq. ft. (2.3 m^2) and under; 4" x 1-1/4" x 16-gauge (100 mm x 30 mm x 1.6 mm) channel for face areas over 25 sq. ft. (2.3 m^2). Provide galvanized steel finish on frame with aluminum touch-up. Air pressure drop shall not exceed 0.10” at 1500 FPM.

2.2 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Provide fire dampers where indicated and where required by NFPA and local authorities. Provide Type "C" fire dampers. Construction shall be in accordance with NFPA 90A and UL 555, and be UL labeled accordingly. Provide fusible link rated at 160°F to 165°F (71°C to 74°C) unless otherwise indicated. Provide damper with positive lock in

closed position. Damper blades shall be fully out of the air stream. Horizontal installations shall have damper blades and closure spring out of air stream. Provide the following features:

1. Damper Blade Assembly: Curtain or multiple blade type.

2. Blade Material: Match casing and ductwork where installed.

3. Provide factory sleeve. Construction shall be minimum 20 gauge. Should duct be heavier than 20 gauge, provide sleeve and frame to match duct and material construction. Sleeves shall be sufficient in length to protrude on both sides of the wall to allow for access door on one side and UL approved breakaway duct connection on both sides.

B. Motor Driven Combination Fire/Smoke Dampers: Provide motor driven fire/smoke dampers in types and sizes indicated and where required by NFPA and local authorities as indicated on the drawings. Dampers shall be multi-blade type with frames and blades constructed of galvanized steel. Dampers shall be UL 555 and 555S listed with Class I leakage characteristics at 250°F (8 CFM/ft^2 at 4” WG). Dampers located in medium pressure systems shall have air foil blades. Dampers in low pressure systems are to be standard “V” groove type. Dampers shall have factory sleeves meeting the requirements of UL. Electric actuators shall be provided by the damper manufacturer and installed at the factory externally on the damper sleeve. Actuators shall be UL approved as an assembly with the damper. Provide end position indicator switches for use by ATC. Duct type smoke detectors shall be furnished under Division-28.

1. Coordinate the damper voltage with the smoke/duct detector relay voltage.

2. See drawings for additional information regarding wiring of smoke and fire/smoke dampers.

C. Dampers shall be as manufactured by Ruskin, Greenheck, Nailor, Air Balance, Pottorff, or United Enertech, subject to compliance with requirements indicated.

D. All dampers shall have a maximum air pressure drop of 0.10” at 1500 FPM.

2.3 TURNING VANES

A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" (40 mm) wide curved blades set at 3/4" o.c. (20 mm), supported with bars perpendicular to blades set at 2" o.c. (50 mm), and set into side strips suitable for mounting in ductwork.

2.4 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test Holes: Provide duct test holes in ductwork at fan inlet and outlet, and elsewhere as indicated, consisting of slot and cover, for instrument tests.

2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12" (300 mm).

Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.5 DUCT ACCESS DOORS

A. General: Provide duct access doors where required for duct accessory access. Provide access doors for fire dampers, smoke dampers and smoke detectors. Install access doors upstream of duct type smoke detectors.

B. Construction: Construct of same or greater gage as ductwork served and provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork and extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" (300 mm) high and smaller, 2 handle-type latches for larger doors.

2.6 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flame retardant fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.7 PENETRATION SEALS

A. Provide seals for all openings through fire-rated walls, floors or ceilings used as passage for mechanical components such as ductwork. See Division-23 section "Basic HVAC Materials and Methods" for penetration seals and firestopping requirements.

B. Provide seals for all openings through walls, floors or ceilings used as passage for mechanical components such as ductwork.

2.8 SOUND ATTENUATORS (SILENCERS)

A. General:

1. Sound attenuator manufacturer shall provide testing in accordance with ASTM E-477-2013.

2. Sound attenuator inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at sound attenuators are not permitted unless shown on the contract drawings.

B. Materials:

1. General:

a. Rectangular Attenuators: All rectangular attenuators shall be constructed with a 22 gauge galvanized steel outer casing and 26 gauge galvanized perforated steel inner wall.

b. Elbow Attenuators: All elbow attenuators shall be constructed with an 18 gauge galvanized steel outer casing and 22 gauge galvanized perforated steel inner wall. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow attenuators with a turning cross-section dimension greater than 48" shall have at least two half splitters and one full splitter.

c. Circular Attenuators: All circular attenuators shall be constructed based on the following constraints:

1) Silencers with a diameter less than 18 inches shall be constructed of no less than 22 gauge casing and 26 gauge perforated metal.

2) Silencers with a diameter between 18 inches and 30 inches shall be constructed of no less than 20 gauge casing and 26 gauge perforated metal.

3) Silencers with a diameter between 30 inches and 54 inches shall be constructed of no less than 18 gauge casing and 22 gauge perforated metal.

4) Silencers with a diameter greater than 54 inches shall be constructed of no less than 18 gauge casing and 22 gauge perforated metal.

d. Access Doors: Where required, attenuators shall be supplied with an access door(s) to permit fire damper service. Access doors shall be supplied as an integral part of the attenuator by the attenuator manufacturer.

2. Dissipative Silencers:

a. Acoustic Media: Media shall be treated with an EPA registered non-toxic anti-microbial agent to protect against mold, mildew, bacteria and fungi. The media shall not contain formaldehydes, phenolic resins or volatile organic compounds (VOC's). The media shall comply with UL 181 and NFPA 90A.

b. Combustion Ratings: Attenuator materials, including glass fiber shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.

Flame Spread Index:	10
Smoke Developed Index:	50

3. Film Lined Silencers:

a. The acoustic media shall be completely wrapped with Vibar™ film to help prevent shedding, erosion and impregnation.

b. Combustion Ratings: Attenuator materials, including glass fiber shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.

Flame Spread Index:	25
Smoke Developed Index:	50

C. Construction:

1. Sound attenuators shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed.

2. Material gauges noted in Paragraph B, are minimums.

3. Material gauges shall be increased as required for the system pressure and velocity classification. The attenuators shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.

4. Where required, silencer shall be constructed from stainless steel or aluminum.

5. Casings shall be lockformed and sealed, except as noted in Paragraph B, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.

6. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

D. Acoustic Performance:

1. Sound attenuator dynamic insertion loss shall not be less than that listed in the attenuator schedule.

2. Sound attenuator generated noise shall not be greater than that listed in the attenuator schedule.

3. Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements.

4. All attenuator ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test attenuator in accordance with the ASTM E-477-06a test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

E. Aerodynamic Performance:

1. Attenuator pressure drops shall not exceed those listed in the attenuator schedule. Attenuator pressure drop measurements shall be made in accordance with the ASTM E-477-06a test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

F. Submittals:

1. Provide acoustical system calculations for all duct systems with attenuators to demonstrate that the resultant ductborne sound levels of the equipment as measured in the occupied spaces meet the specified criteria. In the absence of specified background sound level criteria, the guidelines as expressed in Table 34 of Chapter 47, “Sound and Vibration Control” of the 2003 ASHRAE Handbook - HVAC Applications, shall be used.

2. The manufacturer shall supply certified test data for each scheduled attenuator. The data shall include dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project’s air distribution system requirement. All ratings shall be conducted in the same facility and shall utilize the same attenuator.

G. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to Vibro-Acoustics or Semco.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Provide fire dampers where ducts penetrate a floor slab, and elsewhere as indicated.

C. Install balancing dampers where indicated, and at each ducted air inlet and outlet. Dampers are not required where a single air outlet occurs downstream of an air terminal (VAVs, fan powered boxes, etc.).

D. Install turning vanes in square or rectangular elbows (45 degrees and greater) in supply, return and exhaust air systems, and elsewhere as indicated.

E. Install airtight access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Duct access panels shall be adequately sized to provide access to all fire and/or smoke damper fusible links.

F. All electrical connections to smoke damper actuators and smoke detectors (duct or ceiling mounted) shall be provided by the ATC contractor.

G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 DUCT CLEANING

A. Prior to cleaning or sanitizing ductwork/equipment, all equipment utilized to perform those processes shall be sanitized. Examine ductwork/equipment prior to performing work and provide new duct openings where required to provide visual inspection of the duct interior.

B. Unless indicated otherwise, the systems shall be cleaned and sanitized in the following order:

1. Exhaust systems

2. Return systems

3. Air handling unit(s)

4. Air handling unit supply systems

C. Duct cleaning of the above systems listed shall include air devices, terminal reheat units, etc.

D. Cleaning Process:

1. General:

a. Systems shall be de-energized while duct cleaning and sanitizing are in progress.

b. HEPA filter vacuums shall be used to keep room air clean. Ceiling tile shall be handled with care, and repaired or replaced as required to restore to the original condition.

2. Air Handler Cleaning Procedures:

a. Vacuum completely, beginning with the area upstream of the filters. Filters shall be replaced at the completion of the work.

b. Vacuum the fan and fan chamber.

c. Wash/degrease fan blades as required.

d. Wash/degrease chamber upstream of the coils as required.

e. Clean coils.

f. Sanitize.

3. Coil Cleaning Procedure: The procedure shall be customized to the situation encountered. The most heavily soiled coils may take a more complicated procedure of solution/pressure spraying. Most require only low pressure

application of special cleaning solution and rinsing after they are first fully vacuumed.

4. Furniture Coverage from Incidental Dirt: As required, drape surrounding instruments, computers and areas with plastic to protect them from any incidental dirt generated during the cleaning process. Work environment shall be clean at all times. Floor shall be vacuumed as needed.

5. Duct Cleaning: Cleaning shall be accomplished by mechanical means in conjunction with the use of High CFM HEPA style vacuums and three (3) filtered canister vacuums. Mechanical means may include vacuum brushing of the duct interior, auger style mechanical devices, or high pressure air activated in duct cleaning devices to scrape off any dirt adhered to duct walls. Cleaning may be accomplished by a combination of these methods. Where possible, clean a full run or section before beginning another to insure full cleaning coverage. All material in the vacuum shall be disposed of daily after being treated with a sanitizer.

6. Sanitizing Process: Sanitizing shall be accomplished in two stages. First, it shall be done as each section of the air system is cleaned. The sanitization process shall be repeated again after the complete system has been cleaned. All sanitizing shall be completed before access is sealed. Diffusers shall be cleaned and sanitized. EPA recognized/registered sanitizers only shall be used. MSDS information shall be supplied for materials selected. Sanitizers/encapsulants shall not be used as a substitute for proper cleaning.

7. Clean Tests: Tests for bacteria/fungi shall be performed after all cleaning and sanitizing is completed to insure the clean standards have been met. This shall be done while the system is in operation and shall be a minimum of forty-eight (48) hours after the last sanitation has been completed.

8. Closing and Sealing: Provide galvanized sheet metal plate(s) to be used as access for the majority of locations. Square cut 22 gauge metal shall be used with each plate to lap its edges by one inch all around. Screws shall be placed at four inch (100 mm) intervals and the plate shall be sealed with a water-based fireproof sealant to ensure proper seal of the system to match existing pressure classification.

9. Encapsulation: There may be times when it is necessary to use an encapsulant on interior lined duct. It should be used only if circumstances require it (for example, the lining may be breaking down), and shall be agreed to in advance by the client. It shall not be used as a substitute for cleaning.

10. Duct cleaning shall be performed by Applied Building Technologies, Inc. or equivalent.

3.4 FIELD QUALITY CONTROL

A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper operation.

1. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting and Balancing."

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.6 EXTRA STOCK

A. Furnish extra fusible links to the Owner; one (1) link for every ten (10) installed of each temperature range.

END OF SECTION 23 33 00

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of air outlets and inlets required for project include the following:

1. Ceiling air diffusers

2. Registers and grilles

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".

2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".

4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.

5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, Noise Criteria (NC) levels, static pressure loss, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:

1. Titus

2. Krueger

3. Price

4. Nailor

5. Anemostat

6. Metal Air

2.2 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:

E. Diffuser Materials:

1. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.

2. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

F. Diffuser Faces:

1. Square: Square housing, core of square concentric louvers, square or round duct connection. (See drawings).

2. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection. (See drawings).

3. Perforated: Square, housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.

4. Linear: Extruded aluminum continuous slot, single or multiple.

G. Diffuser Mountings:

1. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.

2. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.

3. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

H. Diffuser Patterns:

1. 1-Way: Fixed louver face for 1-direction air flow, direction indicated on drawings.

2. 2-Way: Fixed louver face for 2-direction air flow, directions indicated on drawings.

3. 3-Way: Fixed louver face for 3-direction air flow, directions indicated on drawings.

4. 4-Way: Fixed louver face for 4-direction air flow, directions indicated on drawings.

5. Induction: Internal aspirator designed to mix air drawn into center core with conditioned air.

I. Diffuser Dampers:

1. Fire Damper: Where indicated, provide combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.

J. Diffuser Finishes:

1. Aluminum Enamel: Air-dried aluminum enamel prime finish.

2. White Enamel: Semi-gloss white enamel prime finish.

3. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

2.3 REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide registers and grilles that have, as a minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Surface Compatibility: Provide registers and grilles with border styles that are compatible with adjacent surfaces, and that are specifically manufactured to fit with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.

D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:

a. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.

b. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

2. Register and Grille Faces:

   a. Horizontal Fixed Blades: Horizontal blades, fixed at 35 degrees, with 3/4" (20 mm) spacing. Blades shall be parallel to long dimension.

3. Register and Grille Patterns:

   a. Single Deflection: 1-set of blades in face.

4. Register and Grille Finishes:

   a. Aluminum Enamel: Air-dried aluminum enamel prime finish.

   b. White Enamel: Semi-gloss white enamel prime finish.

   c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions. Air outlets and inlets shall be independently supported from the structure at two (2) locations and in accordance with recognized industry practices to ensure that products serve intended functions. The ceiling or ceiling grid shall not be considered as a means of support.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

D. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

END OF SECTION 23 37 00

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SECTION 23 62 00 - AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of condensing unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.

B. Types: Types of condensing units specified in this Section include the following:

1. Air cooled condensing units (1 to 7 tons)

2. Air cooled condensing units (7 to 80 tons)

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide condensing units conforming to the following requirements:

1. Air-Conditioning and Refrigeration Institute (ARI): Rate in conformance with ARI 210, "Standard for Unitary Air-Conditioning Equipment," and ARI 270,"Standard for Sound Rating of Outdoor Unitary Equipment" for units up to 7 tons capacity.

a. ARI: Rate and test in conformance with ARI 520, "Standard for Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units" for units up to 200 tons capacity.

2. American National Standards Institute (ANSI): Construct and rate in accordance with ANSI B19.1, "Safety Standard for Air Compressor Systems."

3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and rate in conformance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

4. Underwriters Laboratories, Inc. (UL) or Electrical Testing Laboratories (ETL): Provide units with UL or ETL listing and label.

B. Commissioning Tests: Condensing units shall meet commissioning requirements of paragraphs in Part 3 of this Section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including rated capacities, weights, furnished specialties and accessories and installation and start-up instructions.

B. Drawings: Submit manufacturer's drawings indicating dimensions, required clearances, and refrigeration component balance diagram.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring. Differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts list for each condensing unit, control, and accessory.

E. Commissioning Test Plan: Submit test plan for condensing unit tests specified in Part 3 of this Section. Plan shall include test schedules and names and titles of the test personnel who will be participating in the commissioning tests. The test personnel must be employees of the condensing manufacturer, the manufacturer's designated representatives or employees of an independent testing agency regularly engaged in testing of similar equipment. Plan shall include false loading of condensing units, if the anticipated building loads at the time of test do not meet condensing unit capacity requirements. Submittal shall have detailed layout for temporary equipment, if such equipment are needed even if they are not specified or shown on drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Handle condensing units carefully to prevent damage, denting and scoring. Do not install damaged condensing units or components; replace with new.

B. Storage: Store condensing units and components in a clean dry place. Protect from weather, dirt, water, and construction debris.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Condensing unit manufacturer shall be the same manufacturer as the air handling unit manufacturer where the associated DX coil is located.

2.2 AIR COOLED CONDENSING UNITS: 1 TO 7 TONS

A. General: Provide factory-assembled and tested air cooled condensing units of quantities and capacities scheduled on the drawings, and matched, by the manufacturer, to the evaporator characteristics.

B. Casing: Provide casings of 18-gauge galvanized steel with baked enamel or air-dried powder finish, cadmium plated bolts or wing nuts, removable panels for internal access, louvered protection over condenser fins and cadmium plated or corrosion resistant fan guard.

C. Compressor: Provide welded hermetic compressor with stator thermal overload protector, spring or neoprene isolators, internal pressure relief or high pressure cut out, and crankcase heater.

D. Accessories: Provide the following accessories:

1. Low pressure cutouts

2. High pressure cutout or internal relief

3. Brass cap seal service valves with gauge taps

4. Timed temperature sensitive compressor cycling relay

5. Refrigerant line filter dryer

6. NEMA motor contactor

7. Refrigerant and oil charge

E. Condenser: Provide an air cooled condenser with copper or aluminum tubes and aluminum fins, 400 psig design pressure, direct drive aluminum fans and totally enclosed motor with thermal overload switch, conforming to NEMA MG 1.

1. Provide low ambient cooling controls to 50 degrees F.

2. Provide low ambient cooling controls to 30 degrees F.

3. Provide low ambient cooling controls to 0 degrees F.

F. Piping: Provide pre-charged and insulated suction and liquid tubing of copper conforming to American Society of Testing and Materials (ASTM) B 88, "Standard Specification for Seamless Copper Water Tube."

2.3 AIR COOLED CONDENSING UNITS: 7 TO 80 TONS

A. General: Provide factory-assembled and tested air cooled condensing units, of type, quantity and size indicated on the schedules and the drawings, and suitable for operation in the locations indicated.

B. Casing: Provide casings as follows:

1. Weatherproof for outside installation.

2. Construct of 18 gauge galvanized steel, zinc phosphatized with baked enamel or air dried powder factory finish and removable access panels to compressors, controls and all serviceable components.

3. Provide hinged or lift-out doors with handles and twist-lock hardware. Sheet metal screws will not be acceptable.

4. Provide removable cadmium plated or corrosion resistant fan guards and condenser coil inlet guards.

5. Provide lifting lugs welded to a rigid galvanized steel base.

C. Compressors: Provide reciprocating or scroll type compressors.

1. Provide reversible positive displacement oil pump with factory set oil pressure regulating valve.

2. Provide oil level sight glass, oil filter or strainer, and magnetic plug.

3. Provide a suction gas cooled motor with high temperature motor protection, and suction pressure or electric actuated unloaders.

4. Provide ten (10) year parts and labor warranty if reciprocating compressors are utilized.

D. Condenser: Provide an air cooled condenser with seamless copper tube with aluminum fins.

1. Space fins for cleaning; maximum 200 per foot.

2. Provide separate and independent refrigerant circuits for each compressor.

3. Provide liquid accumulator and sub-cooling circuit.

4. Design and test for 450 psig, factory dehydrate and charge.

5. Provide propeller-type direct drive fans with aluminum or corrosion resistant steel blades, totally enclosed, permanently lubricated squirrel-cage motors, NEMA Code Letter C.

6. Provide fan contactors, with overloads in weatherproof housing.

E. Accessories:

1. Provide low ambient controls to allow operation at ambient temperatures scheduled.

2. Refrigeration system shall be provided with hot gas bypass.

F. Controls: Provide operating controls in a factory-installed weatherproof enclosure. Provide, as a minimum, fan fuses and terminal blocks, fan contactors one per fan, control power circuit transformer and power connection terminal block.

1. Provide molded case circuit breakers or motor circuit thermal protectors with thermal overload trips for each compressor.

2. Provide compressor contactors.

3. Provide recycling pump down relay and manual pump down switch.

4. Provide high and low pressure cutout relays for each compressor.

5. Provide oil pressure cutout switch for each compressor.

6. Provide sequencing relay for multiple compressor units.

7. Provide a five (5) minute compressor restart timer to prevent short-cycling on power failure.

PART 3 - EXECUTION

3.1 INSPECTION

A. Support: Conform to manufacturer's clearance, support and installation requirements.

B. Entrance Dimensions: Verify equipment building entrance requirements.

3.2 INSTALLATION OF CONDENSING UNITS

A. General: Install condensing units in accordance with manufacturer's installation instructions.

B. Refrigerant Piping: Refer to Division-23 Section, "Refrigerant Piping". Provide piping in strict accordance with manufacturer's requirements.

C. Electric Wiring: Provide control and interlock wiring as specified, conforming to manufacturer's requirements. Coordinate field-installed automatic temperature control wiring with Division-23 Section, "Automatic Control Systems."

D. Start-Up: Start-up under direction of a factory-authorized representative and test all controls, safeties and wiring before start-up.

E. Field Test: Field tests during condensing unit installation and start-up tests shall not be considered as fulfilling requirements of commissioning tests.

3.3 COMMISSIONING TESTS

A. Preparation for Tests: Before the scheduled commissioning tests, the Contractor and/or the manufacturer's representative shall have prepared the condensing units in accordance with the recommendations of the manufacturer for start-up and operations.

B. Operational Control Test:

1. Demonstrate proper functioning of the operational controls of the condensing units. Confirm proper operation for the following.

a. Crankcase heater

b. Oil pumping system

c. Compressor unloaders

d. Pump down operation

e. High and low pressure cutouts for each compressor

f. Oil pressure cutout for each compressor

g. Sequencing relay for multiple compressor units

h. Time cycling relay

i. Low ambient controls

2. Demonstrate condensing unit capacity control by varying the space or unit load. The capacity range to be tested shall be from no load to full load and back to no load. The condensing unit must demonstrate stable operation without excess vibration and noise. Each step of the multi-step control (cylinder unloading and/or compressor staging) must be verified.

3. Demonstrate that manual resetting is required to restart compressors for all safety cutouts.

4. All safety control tests must be verified by electric signals at the compressor motor starters or actual stopping of the compressors.

5. Demonstrate proper functioning of all indicating lights.

3.4 TRAINING OF PERSONNEL

A. Training: Provide the services of a manufacturer's technical representative for one (1) four-hour day. Give instructions in operation, start-up, shut-down and maintenance.

1. Schedule training, in writing, seven (7) days in advance.

2. Obtain concurrence for training schedule.

END OF SECTION 23 62 00

SECTION 23 73 13 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of air handling unit work required by this Section is indicated on the drawings, by requirements of this Section, and all other Division-23 Sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide air handling units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.

B. Certifications: Provide certified ratings of units based on tests performed in accordance with ARI 430.

C. Codes and Standards: Provide air handling units conforming to the following:

1. Air Movement and Control Association, Inc. (AMCA): Comply with applicable AMCA including:

a. 210 Laboratory Methods of Testing Fans for Rating Purposes

b. 500 Test Method for Louvers, Dampers, and Shutters

2. Air-Conditioning and Refrigeration Institute (ARI): Comply with applicable ARI including the following:

a. 410 Forced-Circulation Air-Cooling and Air-Heating Coils

b. 430 Central-Station Air-Handling Units

3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

4. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.

5. National Fire Protection Association (NFPA): Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Comply with NFPA 70, "National Electrical

Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units.

6. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."

7. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of air handling units, which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, and finishes of materials, and installation instructions.

B. Shop Drawings: Submit shop drawings showing unit dimensions, weight loadings, required clearances, field connection details and methods of support. Draw to a scale of one half inch to one foot (13 mm to 300 mm), using same sheet size as Contract Drawings. Include field fabricated mixing boxes, dampers and duct connections.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver air handling units with factory-installed shipping skids and lifting lugs; pack small components in factory-fabricated protective containers.

B. Handling: Handle air handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to air handling unit manufacturer.

C. Storage: Store air handling units in clean dry place and protect from weather and construction traffic.

D. Unloading: Comply with manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, shall be limited to the following:

1. Trane
2. Daikin
3. JCI
4. Carrier

2.2 INDOOR AIR HANDLING UNIT

A. Unit layout and configuration shall be as defined in project plans and schedule.

B. Manufacturer to provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Base frame will either be bolted construction or welded construction. Refer to schedule for base height and construction type. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in total height required for proper trap height.

C. UNIT CASING

1. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 125-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

2. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL X P0.65.

3. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.

4. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.

5. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).

6. Floor panels shall be double-wall construction and designed to support a 300-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.

7. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.

8. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft2*ºF/BTU.

9. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.

10. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.

11. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.

12. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

D. ACCESS DOORS

1. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

2. All doors shall be provided with a thermal break construction of door panel and door frame.

3. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.

4. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

5. Handle hardware shall be designed to prevent unintended closure.

6. Access doors shall be hinged and removable without the use of specialized tools.

7. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.

8. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

9. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

10. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

11. Provide a shatterproof thermal dual pane window in all access doors. Window shall be capable of withstanding unit operating pressures and shall be safe for viewing UV-C lamps.

E. PRIMARY DRAIN PANS

1. All cooling coil sections shall be provided with an insulated, double-wall, galvanized drain pan.

2. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements.

3. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

4. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.

5. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.

6. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

7. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.

8. If drain pans are required for heating coils, access sections, or mixing sections they will be indicated in the plans.

F. FANS

1. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components.

2. Provide fans of type and class as specified on the schedule. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there

are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.

3. Direct drive plenum fans with integral frame motors, shall be mounted on isolation bases. Fan shall be dynamically balanced throughout the operating range to a BV-3 (0.20 in/s) per AMCA 204 test standard. Fan and motor shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

G. MOTORS AND DRIVES

1. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.

2. Fan Motors shall be heavy duty, open drip-proof operable at scheduled voltage. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.

3. Direct driven fans utilizing integral frame motors shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

4. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

H. COILS

1. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.

2. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.

3. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

4. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

5. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

6. REFRIGERANT COOLING COILS

   a. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, insides of tubes shall be air dried, charged with dry nitrogen or dry air, and sealed to prevent contamination.

   b. Refrigerant suction and liquid headers shall be constructed of copper tubing. Suction and liquid connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.

   c. Tubes shall be 3/8-inch .012 copper, with aluminum fins.

   d. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

7. ELECTRIC HEATING COILS

   a. A UL-recognized electric heater shall be factory installed. Electric heat to be open-wire resistance heating, installed in the reheat position. Heater to have primary and secondary protection circuits. The contactors for energizing the electric heater shall be magnetic. Electric heaters rated above 48 amps shall be circuited so that no circuit exceeds 48 amps as required by UL and NEC.

   b. The electric heater shall be factory-wired to accommodate SSR-Full Modulating control if the Heater is96 amps or lower. The SSR control can receive a 0-10 VDC signal from a standalone thermostat or building automation system providing full modulating control of the heater. If the Heater is above 96 amps, then SSR-Vernier control is used. The SSR control can receive a 0-10 VDC signal from a standalone thermostat or building automation system providing full modulating control of the first increment of heat. The staged increments are turned on and off by a step controller. As each stage is required to fulfill the demand for heat, the SSR increment is used as fully modulating between stages.

I. FILTERS

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.

2. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule.

J. DAMPERS

1. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 3 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

K. ACCESS SECTIONS

1. Access sections shall be provided where indicated in the schedule and plans to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual.

L. TOTAL ENERGY RECOVERY WHEEL SECTION

1. Total energy recovery wheels shall be provided as indicated on the schedule and drawings. Wheels shall be integral parts of the AHUs and shall be sized per the ventilation requirement of the units. Additional outside air units, or other field assembled and ducted energy recovery devices, are not acceptable. Mixed air units with economizing shall be constructed with internal bypass dampers such that the pressure drop across the wheel does not increase during economizing. External bypass and multiple duct connections are not acceptable.

2. The air handling unit shall be certified by AHRI to contain a rotary energy recovery wheel certified to ANSI/AHRI Standard 1060 and bears the AHRI 1060 label. Performance characteristics of the energy wheel shall be provided as defined by AHRI 1060 definitions. The energy wheel shall be a total energy wheel, with the sensible and latent effectiveness reported and within 5% of each other. The calculated total net effectiveness of the recovery wheel shall not be less than 70% when the specified ventilation flow rate equals the exhaust flow rate. The energy wheel EATR shall be less than the value indicated in the schedule and drawings. Wheel face velocity and pressure drop shall not exceed performance as defined on schedule. The energy recovery cassette shall be an Underwriters Laboratories (UL) Recognized Component certified for mechanical, electrical, and fire safety in accordance with UL Standard 1812.

3. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belts. The total energy recovery wheel shall incorporate a desiccant without the use of binders or adhesives, which may plug the desiccant aperture. The adsorbent shall not be applied as a glued on surface coating and not susceptible to erosion, abrasion, or delamination. Coated segments shall be washable using standard detergent or alkaline-based coil cleaners. The adsorbent shall be selected for its high affinity

for water vapor and shall not dissolve or deliquesce in the presence of water or high humidity. The rim shall be continuous rolled stainless steel to form an even concentric circle to prevent leakage around the rim and to minimize wear of components. All diameter and perimeter seals shall be provided as part of the cassette assembly. Perimeter seals shall be self-adjusting; diameter seals shall be adjustable.

4. Wheel drive motor shall be provided mounted in the cassette frame. Wheel drive motor shall be thermally protected and UL Component Recognized. Drive belts shall not require belt tensioner. On units that require drive belt tensioner for the wheel belt/motor assembly, the unit manufacturer shall provide at no additional charge to the customer a visual inspection every four months, and adjustment if necessary, of the recommended belt tension during the unit warranty period. Wheel motors shall be of the voltage, phase, frequency, and Hp indicated on the schedule and drawings.

5. Wheel bearings shall be permanently sealed and lubricated and have a minimum L-10 life of 400,000 hours.

6. Access doors shall be provided for the removal of wheel segments. Doors shall be located to allow access to the entire upstream and downstream face of each wheel. Adequate space and access shall be provided for energy wheel motor, bearing and belt removal.

7. Energy recovery wheels shall be designed with variable effectiveness control, to vary the wheel recovery capacity. Variable effective control shall be done by an internal bypass damper provided by the AHU Manufacturer. The wheel variable effectiveness control shall have the ability to modulate the total energy recovery ability down to at least 40% of the initial recovery capacity. Variable frequency speed control is not an acceptable method for controlling variable effectiveness.

8. Frost prevention shall be achieved by outside air bypass, return air preheat, or outside air preheat, depending upon design conditions. Frost set point temperatures based on the scheduled design air conditions shall be provided by the AHU Manufacturer. Variable frequency speed control is not an acceptable method of frost control. Winter design supply and exhaust air conditions leaving the energy wheel shall be provided by the AHU Manufacturer and shall include any de-rate in performance due to frost prevention measures.

9. Control of energy wheels shall be incorporated and an integral part of the AHU control systems and shall be as described under the AHU control specifications. Secondary independent wheel controllers are not acceptable.

10. Access doors shall be provided on all air entering and air leaving sides of wheel to allow for wheel maintenance, belt or motor removal. Access doors shall be constructed per Section 2.04.

M. FACTORY WIRING OF LIGHTS, VFDS, MOTORIZED IMPELLER CONTROL PANELS, AND COMBINATION STARTERS/DISCONNECTS

1. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6-inch in length may be contained in FMC.

2. For fan motors not supplied with a factory mounted and wired starter, MICP or VFD, the unit manufacturer shall supply a 4 X 4 NEMA 4 junction box on the exterior of the fan section(s) with wiring, prewired to the fan motor, to allow for ease of field installation of a starter or VFD.

2.3 MOTORS (TYPICAL FOR ALL AIR HANDLING UNITS)

A. See Division-23 Section, “Electrical Provisions for HVAC Equipment” for minimum motor efficiencies and other requirements.

2.4 ELECTRICAL

A. The electrical components shall have an overall short circuit withstand rating of at least 65,000 Ampere Interrupting Capacity and be UL listed as such.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR HANDLING UNITS

A. General: Install air handling units where indicated on the drawings, in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around air handling units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Mounting: Mount air handling units with internal factory furnished isolators in accordance with manufacturer's instructions.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings. Locate freezestats and trap air handling unit drain-pan connections according to manufacturer's recommendations.

F. Duct Connections: Provide ductwork, accessories, and flexible connections as required.

G. Extend condensate drain to nearest drain. Provide trap at drain pan at least 1" (25 mm) deeper than total supply fan pressure in inches of water column. For indoor units, provide a concrete pad of adequate height to allow for proper installation of condensate drain trap above floor.

H. Provide MERV 13 filter media at all return air inlet locations throughout the duration of construction. Filter media shall not be removed until final filters are installed in the air handling units.

3.2 AIR HANDLING UNIT DISASSEMBLY AND REASSEMBLY

A. Where required, the air handling units shall be disassembled by the mechanical contractor, transported with rigging as required to the assigned mechanical rooms located at the building interior, and reassembled in their permanent location. The air handling unit panels, doors, coils, fan base, superstructure, etc, shall be 100% bolted construction to facilitate the disassembly and reassembly procedure. Welded construction shall not be permitted. The manufacturer shall include costs for factory authorized representative(s) to supervise the complete disassembly and reassembly of the air handling units.

B. Upon reassembly of the units, the unit manufacturer representative(s) shall inspect the installation and certify that the unit meets the manufacturer's standards. The inspection/certification shall include, but not be limited to, the following:

1. Pulley alignment and adjustment.

2. Superstructure inspection verifying all panels and unit frame are installed to manufacturer's standards.

3. Spring isolator adjustment and certification.

4. Motor operated damper adjustment and operation verification.

5. Fan motor amperage reading with the fan operating at 60Hz.

6. Belt tension reading and adjustment.

7. Drain pan inspection.

8. Access door operation and adjustment.

9. Filter inspection.

10. Pressure test(s) of the entire unit shall be performed and the maximum allowable leakage shall be one percent (1%) at 125% times the unit operating pressure, but not less than six inches (6") w.c.

C. The owner shall be invited to be present during all testing and inspections and shall be given a minimum of one week notice (5 business days) prior to testing and certification.

D. Upon completion of the inspection and testing, the manufacturer shall provide the installing contractor and the owner a type written report indicating deficiencies found. The deficiencies shall then be corrected to the satisfaction of the manufacturer and the owner.

E. Upon completion of the inspection, testing, certification and start-up, the manufacturer shall provide the owner with a signed letter indicating that all warranties, either implied or expressed, shall remain in effect for a period of two years from the date of final approval by the manufacturer and the owner. The letter shall include the unit serial number, model number, as well as the location and address of the installed units.

3.3 FUNCTIONAL PERFORMANCE TESTING AND VERIFICATION

A. General: In addition to the tests required during and after installation of all mechanical systems, as well as any other formal commissioning requirements, the unit manufacturer shall perform functional performance tests to verify that all systems are designed, installed, calibrated and adjusted to perform as required in the Contract.

B. Comply with all applicable specification sections including, but not be limited to, “Basic HVAC Requirements”, “Testing, Adjusting and Balancing”, “Automatic Temperature Controls” and “Commissioning”, where applicable.

C. Prior to functional performance testing, all indicating, recording and control devices shall be calibrated. A verification calibration report shall be provided with the final test report.

D. Provide functional performance testing to verify proper operation of each control sequence associated with the unit indicated throughout the contract documents.

E. Failure of Tests: Should any test, verification, or demonstration fail to meet the specification requirements, the component of the system causing the failure shall be repaired, replaced or readjusted. The failed test, verification, or demonstration shall then be repeated.

F. A “Functional Performance Test Verification Form” is included at the end of Section 230900. This form (electronic version is available upon request) shall be completed for each air handling unit provided under this contract.

G. Test Report: Upon satisfactory verification of calibration and functional performance tests, a copy of the final test results shall be bound in the operations and maintenance manual. The final report shall also include a full compliance statement, on company letterhead, indicating that all units are installed and functioning per the contract requirements including drawings, specifications, control sequences and accepted submittals.

H. The air handling unit installation shall not be considered complete until all functional performance verification forms, calibration reports and compliance statement have been submitted and reviewed. Submit in accordance with the submittal requirements indicated elsewhere in these specifications.

3.4 EXTRA STOCK

A. Filters: Furnish one (1) extra set of filters for each air handling unit to the owner. In addition, install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Do not operate fans unless filters are in place.

B. Belts: Contractor shall furnish one (1) spare set of belts for each belt-driven air handling unit. Deliver to the Owner's representative and mark with the air handling unit's number.

END OF SECTION 23 73 13

SECTION 23 81 19 - ENVIRONMENTAL CONTROL AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of environmental control air conditioning unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.

B. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide environmental control air conditioning units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be field fabricated.

B. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

C. Codes and Standards: Provide environmental control air conditioning units conforming to the following:

1. Air-Conditioning and Refrigeration Institution (ARI): Comply with ARI 240.

2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

3. National Electrical Manufacturers Association (NEMA): Provide electrical components required as part of environmental control air conditioning units, which comply with NEMA Standards.

4. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of environmental control air conditioning units.

5. Underwriters Laboratories, Inc. (UL): Provide electrical components required as part of environmental control air conditioning units, which have been listed and labeled by UL.

D. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data for air conditioning units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.

B. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver environmental control air conditioning unit with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handling: Handle environmental control air conditioning units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.

C. Storage: Store environmental control air conditioning units in a clean, dry place and protect from weather and construction traffic.

D. Unloading: Comply with manufacturer's rigging instructions for unloading air conditioning units and condensing units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work will be limited to:

1. Mitsubishi

2. Daikin

3. Panasonic

2.2 ENVIRONMENTAL CONTROL AIR CONDITIONING UNITS

A. General: Provide factory assembled air conditioning system complete with split system compact wall mounted packaged evaporator section and matching outdoor unit. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be rated in accordance with ARI Standard 240 and bear the ARI label. A full charge of R-410A for 100 feet of refrigerant tubing shall be provided in the condensing unit. A dry nitrogen

holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal Standards.

B. Capacities: Provide environmental control air conditioning units of capacity and type as indicated on the drawings and schedules.

C. Warranty: The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced at the contractor's expense. Manufacturer shall have ten (10) years' experience in the U.S. market.

D. Components: Provide environmental control air conditioning units that draw air through filter and coils, and that include fans, compressors, cooling coils, reheat coils, filters, remote air cooled condensing units, motors, starters, controls, and all other components necessary for proper operation.

1. Units shall be furnished complete with remote air cooled condensing unit factory assembled and tested by manufacturers of environmental control air conditioning units.

2. For units installed above ceiling, provide a secondary drain pan with leak detection. Leak detection shall alarm at the building automation system (BAS) and shall de-energize the unit.

E. Indoor Evaporator Unit: The indoor evaporator unit shall be factory assembled and wired. The casing shall have a white finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. An adjustable guide vane shall be provided with the ability to change the air flow from horizontal to vertical. A motorized air sweep flow louver shall provide an automatic change in air flow by directing the air from side to side for uniform air distribution. Return air shall be filtered by means of an easily removable washable filter. The evaporator coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The unit electrical power shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

F. Control System: The control system shall consist of two (2) microprocessors interconnected by a single non polar two wire cable as supplied. Wiring shall run from indoor unit to controller direct. NO SPLICES. When running longer lengths or more than one (1) set of remote controller wires together, a double insulated, two wire cable equivalent to that provided e.g. Belden 9407 cable, is mandatory or use shielded two-wire cable. One (1) microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller; provide emergency operation; and control the outdoor unit. The microprocessor within the wall mounted remote controller shall provide automatic cooling; display setpoint and room temperature; a 24 hour on/off timer so that automatic operation can be set on the timer at one (1) hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; control system shall have control continued operation of the air sweep louvers; and provide on-off and system/mode

function switching. Normal operation of the remote controller provides individual system control in which one (1) remote controller and one (1) indoor unit are installed in the same room. The remote controller shall have the capability of controlling up to a maximum of fifty (50) systems at a maximum developed control cable distance of 1,650 feet. The control voltage between the remote controller and the indoor unit shall be 12 volts D.C. The control voltage between the indoor unit and the outdoor unit shall be 12 volts D.C. Both 12VDC shall be generated from the indoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty (20) function self-diagnostics including total hours of compressor run time.

G. Outdoor Unit: The outdoor unit shall be completely factory assembled, piped and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with one (1) direct drive, propeller type fan arranged for horizontal discharge. The motors shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation. The fans shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high performance rotary type with crankcase heater, accumulator and internal thermal overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall be equipped with high pressure switch and have the capability to operate with a maximum height difference of 100 feet and overall refrigerant tubing length of 100 feet between indoor and outdoor sections without the need for line size changes, traps or additional oil. Refrigerant flow from the condenser to be controlled by means of a capillary tube. The condenser coil shall be of non-ferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with smooth plate fins bonded to copper tubing. The coil shall be protected with an integral metal guard. The unit shall be controlled by the microprocessor located in the indoor matching unit. A built-in, low ambient controller will allow cooling to 0 degrees F outdoor temperature. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

H. Wind Baffle: To allow cooling operation in temperature down to zero degrees Fahrenheit, a wind baffle must be installed onto the condensing unit.

I. Electrical Wiring: Provide all electrical circuits in conformance with NFPA 70 and color coded for ease in field tracing.

J. Provide five (5) year parts and labor warranty for A/C condensing units.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL CONTROL AIR CONDITIONING UNIT INSTALLATION

A. General: Install environmental control air conditioning units where indicated on the drawings in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around environmental control air conditioning units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.

D. Refrigerant Piping: Provide field installed refrigerant piping in accordance with Division-23 section, "Refrigerant Piping."

1. Field installed refrigerant piping shall be refrigerant grade, Type L seamless copper tubing.

2. All connections and joints shall be silver soldered or brazed.

3. Pipe sizing and installation details shown on drawings shall be verified by the manufacturer. Piping shall be installed in strict accordance with manufacturer's recommendations regarding sizing and installation details.

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.

3.2 START-UP

A. General: Start and adjust all units installed under this specification under the supervision of an authorized factory trained representative of the manufacturer of each unit. Perform operational checks to make certain that controls and safety devices and systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated.

1. An operational check shall be made to demonstrate compliance with contract requirements, including but not limited to, capacity and control accuracy.

2. A report signed by each factory representative shall be submitted showing test conditions and results.

END OF SECTION 23 81 19

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SECTION 23 81 20 - VARIABLE REFRIGERANT VOLUME SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of variable refrigerant volume system work required by this Section is indicated on drawings and schedules, by requirements of this Section, and all other Division-23 Sections.

B. Refer to the requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide system components that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be field fabricated.

B. Contractor to provide a complete working Variable Refrigerant Volume (VRV) system including all system components and electrical and plumbing systems required for a fully functioning system that will provide space conditions according to the requirements as indicated by ASHRAE for standard indoor conditions. Only three (3) system manufacturers are listed as acceptable for use in this building. Contractor and manufacturer shall determine the specific equipment requirements of each manufacturer in order to satisfy the space conditions as determined by ASHRAE.

C. Certifications: Submit certified technical and test data indicating compliance with the capacities specified.

D. Codes and Standards: Provide system components conforming to the following:

1. Air-Conditioning and Refrigeration Institution (ARI): Comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

2. Air Movement and Control Association, Inc. (AMCA): Comply with AMCA 210, "Laboratory Methods of Testing Fans for Rating Purposes."

3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and install refrigerant coils in accordance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

4. National Electrical Manufacturers Association (NEMA): Provide electrical components required as part of computer room air conditioning units, which comply with NEMA Standards.

5. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of computer room air conditioning units.

6. Underwriters Laboratories, Inc. (UL): Provide electrical components which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Conform to the requirements of Division-01 Section, "Submittals," where applicable.

B. Product Data: Submit manufacturer's product data for air conditioning units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.

C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division-01.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver system components with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handling: Handle system components carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace damaged units with new units.

C. Storage: Store system components in a clean, dry place and protect from weather and construction traffic.

D. Unloading: Comply with manufacturer's rigging instructions for unloading system components, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work shall be limited to the following:

1. Mitsubishi

2. Daikin

3. Sanyo

2.2 CONDENSING UNIT

A. General: Provide condensing unit factory assembled with pre-wired electronic and refrigerant controls, specifically designed for variable refrigerant volume (VRV) applications. Provide all components required for a complete and operational system.

B. Capacities: Provide condensing units of capacity and type as indicated on the drawings and schedules.

C. Components: The refrigeration circuit of the condensing unit shall consist of a rotary compressor, motors, fans, condenser coil, electronic expansion valve, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut-off valves, oil separators, service ports, liquid receivers and accumulators.

D. Sound: The sound pressure dB(A) at rated conditions shall be a value of 55-62 decibels at 3 feet from the front of a single condensing unit. The condensing unit shall be capable of operating at further 52-59 dB(A) in “quiet mode.”

E. Restart: The condensing unit shall automatically restart operation after a power failure and shall not lose any settings during outage.

F. Layout: The condensing unit shall be modular in design and should allow for side-by-side installation with minimal spacing.

G. Safety Devices: Provide high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, overcurrent protection for the inverter and anti-recycling timers. Provide sub-cooling feature. Oil recovery shall be automatic, occurring 1 hour after system start-up and after every 6 hours of operation after that, or as required to maintain oil levels at the condensing unit.

H. Condensing unit shall operate in heating mode to -4 degrees F dry bulb ambient without additional ambient controls.

I. Coils: Air-cooled heat exchange coils shall be copper tubing with aluminum fins. The coils will be set in a vertical formation with air being drawn in through three sides of the unit and discharged out the top of the unit.

J. Compressors: Condensing unit will have one inverter controlled compressor and up to four high efficiency scroll compressors depending on type. Each compressor shall be equipped with a crankcase heater, high pressure safety switch and internal thermal overload protector.

K. Cabinet: Unit cabinet shall be completely weather proof and corrosion resistant.

L. Fan: Unit shall consist of two propeller type, direct drive fans that have multiple speed operation via a DC inverter. Fans shall have internal protection and permanently lubricated bearings.

M. Vibration: Unit shall have internal spring isolators or compressors shall be mounted on vibration damping rubber grommets.

2.3 SOLENOID VALVE KIT (SVK)

A. The SVK box shall be constructed from galvanized steel plate, internally insulated with polyurethane foam.

B. The SVK box shall be connected to each indoor unit or group of indoor units via a dedicated connection which shall provide power and control signals to the solenoid valves within the box.

2.4 BRANCH SELECTOR BOX (BSB)

A. The BS box shall be constructed from galvanized steel plate, internally insulated with polyurethane foam.

B. Provide individual power to each BS box.

C. Provide control wiring between indoor units and BS boxes to the electronic expansion valves (EEVs).

2.5 INDOOR UNITS

A. Indoor Unit Types:

1. Ceiling mounted

2. Wall mounted

3. Floor Mounted Concealed

4. Floor Mounted Console

B. Construction: Unit shall be completely factory assembled and tested. The unit shall consist of factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay and test run switch. Unit shall have auto-swing louver which ensures efficient air distribution, and closes automatically when the unit stops.

C. Fan: Unit fan shall be a direct drive cross-flow fan with statically and dynamically balanced impeller. Fan shall be capable of operating at high, medium and low speeds.

D. Filter: Unit shall be complete with washable, long life filter with mildew proof resin.

E. Coils: Shall be direct expansion type constructed from copper tubes with aluminum fins. The coil shall be a two row cross fin copper evaporator coil with 14 fins per inch design.

F. For units installed above ceiling, provide a secondary drain pan with leak detection. Leak detection shall alarm at the building automation system (BAS) and shall de-energize the unit.

2.6 CONTROLLER

A. Simple-Wired Room Controller

1. Basic System Controller

2. Provide central control system that will allow global changes and monitoring of all system components from a central location.

2.7 UTILITY REBATE

A. Utility Rebate Application: The mechanical contractor shall provide and submit a utility rebate application to the local utility (BGE Smart Energy Program, or other local utility serving this project area) for the major HVAC equipment (such as chillers, packaged A/C units, variable refrigerant flow systems, etc.). The rebate application shall include all information required by the utility company program administrator (ICF International, or other rebate administrator) including, but not limited to, the application, supporting calculations, analysis, comparison of the proposed equipment to baseline equipment or system., etc.; all as defined and/or required by the program administrator. The Owner shall be indicated on the application as the recipient for the full rebate.

PART 3 - EXECUTION

3.1 VARIABLE REFRIGERANT VOLUME SYSTEM INSTALLATION

A. General: Install system components where indicated on the drawings in accordance with equipment manufacturer's published installation Instructions.

B. Access: Provide access space around system components for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections.

D. Refrigerant Piping: Provide field installed refrigerant piping in accordance with Division-23 section, "Refrigerant Piping."

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings. Provide ball valves at each indoor unit for ease of system isolation.

3.2 START-UP

A. General: Start and adjust all units installed under this specification under the supervision of an authorized factory trained representative of the manufacturer of each unit. Perform operational checks to make certain that controls and safety devices and systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated.

1. An operational check shall be made to demonstrate compliance with contract requirements, including but not limited to, capacity and control accuracy.

2. A report, signed by each factory representative, shall be submitted showing test conditions and results.

END OF SECTION 23 81 20

SECTION 23 82 00 - HEATING AND COOLING TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of terminal unit work is indicated by drawings and schedules, and by requirements of this section and all other Division-23 sections.

B. Types of terminal units required for project include the following:

1. Unit heaters

2. Cabinet heaters

C. Refer to requirements of Division-26.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. I=B=R Compliance: Test and rate finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.

2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced Circulation Air-Cooling and Air-Heating Coils".

3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".

4. ARI Compliance: Test and rate fan coil units in accordance with ARI Standard 440 "Room Fan Coil Air-Conditioners".

5. UL Compliance: Construct and install fan coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units”.

6. ARI Compliance: Test and rate unit ventilators in accordance with ARI Standard 330 "Unit Ventilators".

7. UL Compliance: Provide electrical components for terminal units which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.

B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

1.

2.2 ELECTRIC CABINET HEATERS

A. General: Provide cabinet heaters where indicated, of sizes and capacities as scheduled. All units shall be UL listed.

B. Cabinets: Basic unit shall be blow-through design with motor and fans in the air stream below electric heating bank. Fan discharge shall be baffled to insure even air flow through entire area of heating bank for even outlet temperatures.

1. All solid panels of the front, top and bottom panels shall be internally insulated to provide quiet operation and low surface temperatures. Complete unit assembly shall be listed and approved by Underwriters' Laboratory, Inc.

2. Casing shall be given a 5-stage phosphatizing treatment prior to application of high gloss baked enamel finish. Casing top and front shall be 16 gauge (1.6 mm) with 18 gauge (1.3 mm) front accent panel. Discharge grille shall be a continuous stamped louver. Front access panel fasteners shall be Phillips head.

3. All recessed units shall have wall-guard type recess flanges which protect the wall from direct contact and damage when access panels are removed or replaced for normal maintenance.

C. Elements: The electric heating bank shall consist of metal sheath heating elements. The elements shall have a copper clad steel sheath for strength and corrosion resistance and aluminum fins. Fin tubes shall be installed or removed individually, and shall be center anchored to insure noiseless expansion and contraction.

D. Motors and Fans: Motor and fan assembly shall be direct drive on all unit sizes, using extended motor shaft on one fan unit, double extended motor shafts on two fan units and coupling with hollow steel shafts and end bearing on three, four and five fan units. Two-speed permanent split capacitor type motors with built-in automatic reset motor overload protection shall be standard.

1. Fans shall be forwardly curved double inlet centrifugal type, aluminum construction and shall be modular in design.

2. Motor and fans shall be mounted on an extra heavy 14 gauge (2.0 mm) galvanized mounting plate, forming an easily removable assembly. Motor leads shall be plug-in type for easy removal of the motor and fan assembly. Combination two-speed, two-heat tamperproof switch shall be located with access through discharge air grille, using Allen key for adjustment.

E. Filters: Provide permanent, reusable polyurethane type filters. All models shall have filter access through removable front access panel.

F. Controls: Automatic reset snap-action type thermal protection shall be furnished through holding coil circuit of the control system relay(s) for protection in the event of overheating due to air blockage from any cause. Thermal protector shall be linear type to sense temperatures the entire length of heating elements, to detect localized overheating from partial air blockages.

1. Integral thermostat control shall be standard on floor and wall mounted units, and shall consist of factory built-in thermostat of sensitive bulb and capillary type, fully enclosed and snap-acting to prevent radio or TV interference, The thermostat shall have a temperature adjustment range between 45°F (7°C) and 95°F (35°C).

2. Ceiling mounted units shall be provided with remote wall mounted thermostats.

3. Thermostat operates the single-phase holding coil circuit of the integrally mounted power control relay(s). This single phase relay holding coil circuit shall be powered from the cabinet unit heater main power supply.

4. An integral fan delay switch shall be standard to prevent discharge of cold air, by delaying start-up of the fan motor until heating elements have warmed up. This same fan delay switch shall maintain motor operation after heating elements have been de-energized to dissipate any residual heat.

5. Units shall be equipped as standard with a two speed/two heat selector switch which permits simultaneous tamper-resistant "high-low" adjustment of fan speed and heat output by means of an Allen key through discharge grille.

6. Units shall be provided with built-in circuit breakers. Ceiling mounted units shall be complete with a low voltage control transformer for remote wall mounted thermostat.

2.3 ELECTRIC UNIT HEATERS

A. General: Provide unit heaters where indicated, of sizes and capacities as scheduled. All units shall be UL listed.

B. Cabinets: The cabinet shall be constructed from 18 gauge (1.3 mm) die formed, furniture grade steel.

1. Individually adjustable louvers with 30 degree downward stops shall be furnished.

2. All metal surfaces of the casing shall be phosphate coated to resist corrosion and finished with baked enamel.

3. Provide mounting brackets as required.

C. Elements: The electric heating bank shall consist of metal sheath heating elements. The elements shall have a copper clad steel sheath and aluminum fins.

D. Motors and Fans: Motors shall be totally enclosed, continuous heavy duty all-angle operation, equipped with built-in thermal overload protection. Fans shall be aluminum, directly connected to fan motor, designed specifically for unit heater application.

E. Controls: Automatic reset thermal overheat protector shall be of the linear capillary type, wired for instantaneous de-energizing in case of thermal overload.

1. Fans shall be complete with delay feature to eliminate cold draft. Element shall heat-up before fan energizes, then fan continues to distribute heat after element shuts off.

2. Provide a low voltage control transformer for remote wall mounted thermostat and summer fan switch.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNIT HEATERS

A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.

D. Support units with rod-type hangers anchored to building substrate.

E. Install piping as indicated.

F. Protect units with protective covers during balance of construction.

3.3 INSTALLATION OF CABINET HEATERS

A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.4 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.5 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

3.6 EXTRA STOCK

A. Filters: Furnish one (1) extra set of filters for each terminal unit to the owner. In addition, install new filters at completion of terminal unit work, and prior to testing, adjusting, and balancing work. Do not operate fans unless filters are in place.

B. Belts: Contractor shall furnish one (1) spare set of belts for distinct terminal unit size. Deliver to the Owner's representative and mark with the terminal unit size.

END OF SECTION 23 82 00

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SECTION 260010 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. The requirements indicated in this specification section shall apply to all electrical work.

B. Equipment: All electrical equipment, including but not limited to, wiring devices, wiring materials and electrical construction materials shall be new and of the highest quality and latest improved design.

C. Workmanship: Workmanship shall be of the highest grade and all installation work shall be performed by thoroughly qualified mechanics of the appropriate trade. All equipment shall be installed and connected in accordance with the best engineering practice. Manufacturer’s instructions and recommendations shall be followed and all electric connections shall be provided.

D. Completeness: The Contractor shall furnish and install all labor, materials, tools, equipment, programming, software, startup, licenses, and services as required to make all equipment complete and fully operational. Provide all required mounting hangers, supports, hardware and accessories to install all equipment and devices. Make all equipment and devices complete and fully operational.

E. Drawings: The drawings showing the layout of the electrical system indicate approximate locations of outlets, apparatus and equipment. The runs of feeders and branches as shown, the drawings are schematic only and are not intended to show the exact routing and location of conduits and conduit terminations. The final determination as to routing, location and termination shall be governed by structural conditions, obstructions and job conditions. This shall not be construed to mean that the design of the system may be changed without the written approval of the Engineer; it merely refers to the exact run of raceways and the exact placement of outlets, etc. It shall be the Contractor's responsibility to obtain all shop drawings affecting conduit terminations to the equipment specified in this or other sections or furnished by others, and to verify conduit locations before installation. The Contractor shall consult all contract drawings and specifications which may affect the location of any outlet, equipment or conduit run, to avoid improper locations of such items and to avoid interference with other trades.

F. Accessibility: Electrical equipment such as junction and pull boxes, panelboards, switches, controls, and other apparatus that may require maintenance or operation from time to time, shall be made easily accessible. Although the equipment may be shown on the drawings in certain locations, in the course of building construction, it may develop that such locations do not afford proper accessibility, in which case the Contractor shall direct the Engineer's attention to the condition before advancing the construction.

G. Site examinations: All bidders, prior to submitting a bid, shall thoroughly acquaint themselves with the conditions under which the work will be performed. No allowance shall be made subsequently in connection with this, for any error or negligence on the contractor's part.

H. Unless noted as "EXISTING", "BY OTHERS" or "NIC", all work, devices and equipment are new and shall be furnished and installed by the contractor.

I. The contractor shall comply with all the requirements indicated in the contract documents. The contractor shall provide all the items indicated in the contract documents, without any additional cost or time extension, regardless of whether or not the item is a special order, the item is in short supply, the item has a minimum quantity order requirement, the item has a long lead time, and/or the item has additional/non-standard costs associated with it. The contractor shall coordinate with the manufacturer and supplier of the item prior to submitting a bid.

J. Where there is a conflict in the Contract Documents, contact the owner and the engineer immediately. The owner and the engineer will provide further direction. For pricing and bidding purposes, the more stringent or higher quality requirement shall be used. All work shall comply with all applicable codes, and shall be inspected and approved by the Authority Having Jurisdiction.

K. Furnish and install devices and equipment in accordance with the NEC, the manufacturer's recommendations, and the contract documents.

L. All devices and equipment shall be suitable for its intended use, environment, and location in accordance with the NEC, UL, the manufacturer's recommendations and the contract documents.

M. All work shall be coordinated with the electrical contractor.

N. Wire lugs, connectors and splices shall be UL Listed and shall be compatible with the wire size/material/type. Coordinate equipment and wiring to ensure that they are compatible with each other.

O. The following applies to circuits rated 600V or less:
   1. For circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, the equipment shall be listed and identified for use with 75 degrees C conductors, unless otherwise noted.

P. The ABBREVIATIONS indicated in the electrical drawings shall also apply to the abbreviations used in the electrical specifications, unless otherwise noted.

Q. Exact location of electrical receptacles/floor boxes and/or electrical connections to equipment shall be coordinated with the exact location of items in the field (including, but not limited to, the following: exact location of cabinets/backsplashes/countertops/electrified systems furniture associated with the receptacles/floor boxes, exact locations of equipment, etc.); and, shall be coordinated with the exact location of wire terminals at the equipment (which shall be based on the wiring diagrams of the equipment, the installation manuals of the equipment, and/or coordination with the manufacturer). Coordination shall take place prior to starting any work.

R. Wet Locations:
   1. The following areas shall be considered Wet Locations and shall be provided with equipment/materials that are suitable for Wet Locations in accordance with the NEC and the contract documents:
      a. All outdoor or exterior locations

2. Hangers, supports, raceways, boxes, and other equipment/materials shall be suitable for use in Wet Locations in accordance with the NEC and the contract documents.

S. Where there are space heating equipment located adjacent to electrical equipment (including but not limited to, infrared unit heaters, electric/gas fired unit heaters, etc), the contractor shall coordinate with the manufacturer of the space heating equipment, get the installation manuals for the space heating equipment, and determine the clearance requirements around the space heating equipment. The contractor shall comply with the clearance requirements of the manufacturer, and shall not install any electrical equipment/wiring/conduit within the clearance area. Additionally, all electrical equipment/wiring/conduit shall be provided with appropriate clearance from space heating equipment, so that their maximum operating temperature, and/or temperature rating, is not exceeded.

T. Service equipment shall be UL labeled for use as service equipment. Provide grounding and bonding of service equipment in accordance with NEC requirements.

U. Inside the sally port, storage room, trash room, garage, and rooms which can be entered by vehicles, keep the space directly in front of the exterior door (overhead door, rollup door, swing door, etc.) clear of all electrical items. The volume of the clear space shall not be less than the following:
1. Volume of clear space = width of the exterior door opening x height of the exterior door opening x distance from the exterior door to the opposite wall

V. Where the contract documents specifies a product name, model, or manufacturer, and this product has been discontinued or is no longer in production, the contractor shall provide a product from the same manufacturer, that meets the requirements indicated in the contract documents, at no additional cost to the owner. The product provided by the contractor shall be an approved equal of the specified product. Also, the contractor shall provide a written statement from the specified manufacturer, indicating that the specified product has been discontinued or is no longer in production. All products shall be submitted for review and approval by the design team.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with electrical construction code requirements of State, City and such other local political subdivision specifications as may exceed the requirements of national codes, standards and approving bodies.

B. All electrical equipment installed under this contract shall bear UL label. Equipment shall be installed in accordance with the requirements of UL and the manufacturer.

C. Comply with the National Electrical Code.

D. Certificates and Permits: Upon completion of work, and prior to final payment, furnish to the Engineer formal certification of final inspections from authorities having jurisdiction and secure required permits or certificates (if any) from such authorities. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction. All the cost for obtaining certificates and permits will be paid by the Contractor.

1.4 REFERENCES AND DEFINITIONS

A. Basic References: The following codes, standards, and approvals as referenced throughout the drawings and specifications, shall serve as the minimum standards and quality requirements directly appropriate to the work and workmanship. References to catalogs, standards, codes, specifications and recommendations, etc., means latest edition of such publications in effect at the date of invitation to submit bid.

1. American National Standards Institute (ANSI): ANSI C2; National Electrical Safety Code .
2. National Electric Manufacturer's Association (NEMA) Standards as apply to specified Products.
3. National Fire Protection Association (NFPA): NFPA 70 (National Electrical Code), NFPA 72 (National Fire Alarm Code), NFPA 70E (Standard for Electrical Safety Requirements for Employee Workplaces), and other applicable NFPA codes
4. Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals shall govern the quality and performance of specified Products.
5. Americans with Disabilities Act (ADA)
6. Institute of Electrical and Electronics Engineers, Inc (IEEE)
7. National Electrical Contractor’s Association (NECA)
8. International Electrical Testing Association (NETA)
9. Occupational Safety and Health Administration (OSHA)
10. Code of Maryland Regulations (COMAR)

B. Definitions:

1. “Provide” - means “furnish and install”
2. “Indicated” - means “indicated in contract documents”
3. “Concealed” - means items referred to are hidden from normal sight, this includes items partly excavated or crawl spaces and in service tunnels used solely for repairs and maintenance
4. “Exposed” - means items are not “concealed”
5. “Feeder” - means “All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device”
6. “Feeder circuit breakers” - means circuit breakers protecting feeders.
7. NETA ATS - International Electrical Testing Association Acceptance Testing Specifications, Latest Edition
8. “Building” – A structure that stands alone or that is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors
9. “degrees C” – means “degrees Celsius”
10. “degrees F” – means “degrees Fahrenheit”
11. “homerun” – This word shall refer to that portion of the electrical circuit wiring and conduit between the circuit breaker or fuse protecting the electrical circuit, and the first equipment or load on the electric circuit. There is no other equipment or load on the electrical circuit between the first equipment or load, and the circuit breaker or fuse. For example, a 120V, 20A circuit breaker feeds #12 AWG wiring which connects to 3 – NEMA 5-20R receptacles. The wiring and conduit that runs from the circuit breaker to the 1st receptacle is considered the homerun wiring and conduit. There is no other receptacle on the electrical circuit between the 1st receptacle and the circuit breaker.
12. “duct” – This word shall mean conduit that are installed underground
13. “Branch circuit” – means “The circuit conductors between the final overcurrent device protecting the circuit and the outlets(s).”
14. “Suspended ceiling” – Suspended ceiling (sometimes referred to as dropped ceiling or false ceiling) is a secondary ceiling suspended or supported from the building structure

above, creating a void between the underside of the building structure and the top of the suspended ceiling. Suspended ceilings include, but are not limited to, grid type ceilings, gypsum board ceilings, drywall type ceilings, and other ceilings which are located below the building structure. Suspended ceilings are either accessible ceilings (including, but not limited to, grid type ceilings with removable ceiling panels or tiles) or non-accessible ceilings (including, but not limited to, gypsum board ceilings and drywall type ceilings).

1.5 SUBMITTALS

A. Product Data: Submit Product Data applicable to items listed under Submittals in each Section of Division 26, 27, and 28; and such items as may be indicated on the Drawings.

B. Coordination Drawings:

1. Where the contractor has any question or request-for-information that relates to locations of equipment, or coordination of equipment locations, the contractor shall provide a coordination drawing together with the question or request-for-information. The coordination drawing shall have reflected ceiling plans, structural plans, floor plans and other relevant drawings, drawn to scale on one drawing, on which the following items are shown and coordinated with each other, based on actual dimensions of the items, input from actual installer of the items involved, and existing conditions (the contractor shall field measure all existing conditions):

a. Routing of underground ducts or ductbanks.
b. Routing of conduit encased in concrete slab.
c. Routing of electrical wiring/conduit
d. Structural beams, trusses and columns.
e. Motors and all other mechanical equipment.
f. Mechanical pipes and ducts
g. Junction/pull boxes and electrical enclosures
h. Electrical Distribution Equipment (switchgear, transformers, motor control centers, panelboards, switchboards, etc.)
i. All equipment/devices which are relevant to the question or request-for-information

C. Shop Drawings

1. General: The Contractor shall submit to the Engineer for approval, before fabrication, detailed shop drawings for all electrical equipment and materials.
2. Shop drawings shall clearly indicate, using arrows and/or highlighting on all copies, which items are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in these specifications. All pertinent specification and drawing requirements shall be indicated on the manufacturer’s drawings. Complete model number of equipment shall be indicated.
3. Shop drawing shall include a cover sheet that indicates the project name, the name of the contractor, and the name of the supplier/distributer.
4. Shop drawing shall have a summary page that indicates the following: quantities of all equipment, manufacturer/model number for all equipment, and lead time for all equipment.
5. Shop drawings of related equipment shall be submitted together.

D. "As-Built" Drawings:

1. The contractor shall provide “as-built” drawings, in both electronic and hardcopy formats. The contractor shall provide accurate project record drawings, showing in red color on

the working drawings and electrical drawings, all changes, modifications, and alterations from the original drawings, made during installation of the work. Upon completion of the work, the contractor shall provide the Owner with a USB drive that has an electronic copy of the project record drawings, and a full size hardcopy of the project record drawings.

E. Operating and Maintenance Manuals

1. General: Upon completion of the work, the Contractor shall furnish Operating and Maintenance Manuals for use by the Owner. The manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of catalogs, brochures, bulletins, charts, schedules and drawings describing location, operation, maintenance, lubrication, operating weight and other information necessary for the Owner to establish an effective operating and maintenance program.
2. Shop Drawings: Copies of appropriate shop drawings shall be included in the Operating and Maintenance Manuals. The requirements for manuals is a separate contractual item and in no way supersedes the requirements for shop drawings and vice-versa.
3. Approval: Completed manuals shall be submitted to the Engineer for review and approval. Incomplete or inadequate manuals will be returned to the Contractor for correction and resubmission.
4. Provide an electronic copy (PDF format) on 3 USB drives, and 3 hardcopies in 3-ring binders, of all operating and maintenance manuals, unless a greater quantity is specified elsewhere in the contract documents, in which case the greater quantity shall apply. Each drive and each hardcopy shall have all the operating and maintenance manuals for all the equipment.
5. Equipment keys and passwords shall be provided to the Owner’s authorized representative or representatives. A document shall be provided indicating who received the keys and what are the passwords. Document shall be neat and typewritten.
6. Provide a separate section in the O&M Manuals for maintenance testing schedules of all equipment. A factory authorized representative of the equipment manufacturer shall certify the maintenance program. Include calendar schedule in table format to indicate all maintenance actions included during the warranty period with spaces for future testing.
7. All factory and field test reports by the contractor, manufacturer, and/or independent testing company shall be included in the O&M Manuals.
8. Wiring diagrams for all factory and field wiring shall be included in the O&M Manuals.

F. Spare Parts and Accessories List

1. A complete list of spare parts and accessories for equipment shall be provided.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.

B. Delivered electrical equipment crating and/or packaging shall clearly identify pick-points or lift-points. In the absence of crating or packaging, pick-points or lift-points must be identified on the equipment.

C. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with the manufacturer’s written instructions.

D. The Contractor shall determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

E. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions. Keep equipment in a dry location.

1. Temporary Heating: Apply temporary heat to materials and equipment, according to manufacturer's written instructions, throughout periods when environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

1.7 WARRANTY

A. The Contractor shall guarantee that all work performed, and all materials/equipment installed by him, are free from defects. The Contractor shall repair or replace any defective equipment, materials or workmanship, free of cost to the Owner, for a period of two (2) years from the date of final acceptance of the Contractor’s work. The date of final acceptance is determined by the Owner. Where individual specification sections indicate a Warranty period longer than two (2) years, the longer warranty period shall apply.

B. During this warranty period the Contractor shall:

1. Correct and make good all electrical defects. Faulty equipment and materials shall be repaired or replaced as required to produce satisfactory results as directed by the engineer and without additional cost to the Owner. Contractor shall provide service within 24 hours after the call has been made by the Owner.

1.8 DAMAGE TO OTHER WORK

A. Damage: Cutting or damage to existing structures, surfaces or installations shall be repaired at the expense of the Contractor. All such repairs or patching shall be neatly done by mechanics of the appropriate trade, and shall be done in such a fashion as to leave no readily apparent joint or change in appearance, and to leave no structural or other weakness.

1.9 TEMPORARY POWER

A. Contractor shall be entirely responsible for temporary power. All applications, fees, temporary connections, etc. shall be made by the contractor.

1.10 COORDINATION

A. General: The Contractor shall coordinate the work performed and equipment furnished by the Electrical Contractor with work performed and equipment furnished by other trades to ensure a complete and satisfactory installation.

B. For all site work, comply with all the requirements of the state or local jurisdiction which apply to locating existing utilities. The requirements in Maryland include, but are not limited to, contacting “Miss Utility” prior to starting any site work.

1.11 INTERRUPTION OF ELECTRIC SERVICE

A. Do not interrupt electric, data, telephone, and/or cable tv services to facilities occupied by the owner or others, unless permitted under the following conditions, and then only after arranging to provide temporary electric, data, telephone and/or cable tv services, according to requirements indicated:

1. Notify the owner no fewer than 14 days in advance of proposed interruption of electric, data, telephone, and/or cable tv services.
2. Do not proceed with interruption of electric, data, telephone, and/or cable tv services without the owner's written permission.

1.12 CONTRACTOR'S CERTIFICATION

A. The Contractor shall submit a signed and dated letter to the owner and the engineer certifying the following:
1. He shall certify that all work has been performed in accordance with the contract documents (including, but not limited to: any amendments, addendums, and contract modifications) ;
2. He shall certify that all work has been inspected and approved by the Authorities Having Jurisdiction; AND,
3. He shall certify that all work has been performed in accordance with the National Electrical Code and all applicable codes.

1.13 ELECTRICAL WORK FOR MECHANICAL AND PLUMBING EQUIPMENT

A. Additional HVAC (Heating, Ventilation, and Air Conditioning) and Plumbing circuits/wiring are indicated in the mechanical/plumbing drawings and specifications. The electrical contractor shall coordinate with the mechanical/plumbing contractor to make sure that all the circuits/wiring required in order to make the HVAC/Plumbing system complete and fully operational are included in the bid price. All HVAC/Plumbing circuits/wiring shall be provided in accordance with the NEC and the Contract Documents. Wiring shown in the mechanical/plumbing drawings and specifications include, but are not limited to: wiring for dampers, thermostats, and other HVAC/Plumbing power/controls.

B. Prior to submitting a bid or a price proposal, coordinate with the mechanical/plumbing contractor. Get wiring diagrams, cut sheets, installation/operation manuals, and other information regarding the equipment.

C. Coordinate exact location and quantities of equipment with the mechanical/plumbing contractor.

D. Provide wiring, conduit, mounting supports, hardware, and accessories (including, but not limited to: control switches, push buttons, safety devices, disconnects, starters, audio/visual indicators, interlocks, limit switches, remote stations, detector devices, etc.) as required for a complete, fully operational, and code compliant system.

E. All work shall comply with the manufacturer's recommendations and NEC requirements.

1.14 ELECTRICAL WORK FOR MISCELLANEOUS EQUIPMENT

A. For all equipment that require electrical connections, provide wiring, conduit, and equipment accessories (including, but not limited to: control switches, push buttons, safety devices, disconnects, starters, audio/visual indicators, interlocks, limit switches, remote stations, detector devices, sensors, controls, speakers, audio/visual devices, level/pressure instruments, power supplies, etc.) as required for a complete and fully operational, and code compliant system. The equipment accessories are specified in the contract documents (including, but not limited to, drawings and specifications) associated with each equipment. For example, the accessories associated with the overhead door are indicated in the overhead door specifications

B. Prior to submitting a bid or a price proposal, coordinate with the contractor that is furnishing the miscellaneous equipment. Get wiring diagrams, cut sheets, installation/operation manuals, and other information regarding the equipment.

C. Coordinate exact location and quantities of miscellaneous equipment with the contractor that is furnishing the miscellaneous equipment.

D. All work shall comply with the manufacturer's recommendations and NEC requirements.

1.15 VIDEO RECORDING OF DEMONSTRATION AND TRAINING

A. A professional camera firm shall provide a video recording of all demonstration and training. The demonstration and training video shall be saved onto portable external hard drives. 3 sets of portable external hard drives shall be provided to the owner.

1.16 TRACER WIRE

A. Provide tracer wire for underground civil and/or plumbing utilities in accordance with State, Local Jurisdiction, and/or Utility requirements. All work shall comply with the NEC, and State/Local Jurisdiction/Utility requirements. Coordinate with Civil and/or Plumbing drawings/specifications/contractors.

1.17 TRAINING

A. Provide training for all equipment. Schedule training with at least 21 days advance notice, to the owner and engineer, by submitting a draft training schedule. Indicate all proposed training dates with specific equipment descriptions. The Contractor shall then confirm these dates with the owner and engineer. After receiving approval of these dates, the Contractor shall submit a final training schedule at least 14 days prior to the agreed upon dates.

B. Provide a minimum of 4 hours of training for each equipment. Where individual specification sections indicate a training period longer than 4 hours, the longer training period shall apply.

END OF SECTION 260010

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SECTION 260200 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:

1. Qualifications of testing agencies and their personnel.
2. Suitability of test equipment.
3. Calibration of test instruments.
4. Coordination requirements for testing and inspecting.
5. Reporting requirements for testing and inspecting.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.

1. Independent Testing Agencies: Independent of manufacturers, suppliers, and installers of components to be tested or inspected.

a. Testing Agency's Field Supervisor for Power Component Testing: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Division 26 Specification Sections.

B. Test Equipment Suitability: Comply with NETA ATS

C. Test Equipment Calibration: Comply with NETA ATS

1.4 SUBMITTALS:

A. Provide qualification data for testing agency. Qualification data shall include: corporate history and corporate resume, key personnel and project supervisor resumes, 10 similar projects with scope descriptions, 5 similar testing project reference names and contact information, copy of all certifications, samples of all test report sheets, and corporate safety procedures manual.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 TESTS AND INSPECTIONS

A. See individual Specification Sections for Tests and Inspections required on Electrical Systems.

B. In addition to the requirements indicated in each individual Specification Section, comply with all of the following:
   1. Provide a Test Report for each test that indicates the following:
      a. Test procedures used.
      b. Test results that comply with requirements.
      c. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.
   2. At the beginning of each test report, provide an executive summary that indicates whether each equipment has PASSED all the specified tests or FAILED one or more tests. Where the equipment has failed, the summary shall indicate each test that FAILED. Where the equipment has failed, the summary shall provide a recommendation for corrective action.
   3. Remove and replace malfunctioning equipment and test new equipment at no additional cost to the owner. Submit test reports.
   4. Where a Test Report uses a specific name/label/designation for a particular equipment, that name/label/designation shall be consistent with the name/label/designation indicated in the Contract Documents and in the field.

END OF SECTION - 260200

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Touch up paint
6. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. NECA: National Electrical Contractors Association

1.4 SUBMITTALS

A. Product Data: Provide product data for all items indicated in this specification section.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. Connecting raceways, cables, wireways, cable trays, and busways shall be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate sleeve selection and application with selection and application of firestopping.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 ACCESS DOORS

A. Door and frame shall be constructed of steel, 16 gauge minimum. Access door shall have a continuous piano hinge. Door shall have a flush mounted lock. Finish shall be prime coat of rust inhibitive electrostatic powder, baked enamel. Access door shall be field painted to match the surrounding wall or ceiling.

B. Provide fire rated access doors to maintain the fire rating of wall and ceiling assemblies, to restore original fire-resistance rating of assembly.

2.5 DUCT-SEALING COMPOUND

A. Duct-sealing compound shall be Polywater FST Foam Sealant or approved equal. Duct-sealing compound shall be a 2-part, 98% closed-cell urethane foam. It shall react and set in 5-10 minutes at 70 degrees F. It shall be capable of sealing 3/4” to 10” conduits with multiple cable configurations. Duct-sealing compound shall be re-enterable. It shall be capable of withstanding temperatures from -20 degrees F to 200 degrees F continuous, and be chemically resistant to gasoline, oils, dilute acids, and bases. Duct-sealing compound shall not affect the physical or electrical properties of wires and cables.

B. Duct-sealing compound shall have good adhesion to duct and cable jacket surfaces with good structural strength. It shall have 120 lb. compressive strength (ASTM D1621). Duct-sealing compound shall be capable of holding 22 feet water head pressure continuous, or 90 feet water head pressure short-term. It shall block up to 5 psi gas or vapor continuous. It shall meet NEC codes for Raceway Seals, meet UL 94 fire rating HBF, and be UL recognized.

C. Duct-sealing compound shall be compatible with the wires/cables used in the project. The cured foam is an inert solid that does not affect wire/cable components. It does not change the physical or electrical properties of wires/cables, based on tensile – elongation and volume resistivity testing.

D. Duct-sealing compound shall have excellent adhesion to PVC, rigid steel, EMT, IMC, fiberglass, and polyethylene conduits.

2.6 TOUCH UP PAINT

A. Provide touch up paint from the manufacturer of the electrical equipment. Paint shall match the finish of the equipment. At a minimum, provide touch up paint all power distribution equipment.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Comply with NFPA 70, National Electrical Code.

C. Mounting heights indicated in the contract documents are measured from the finished floor or finished grade to the bottom of the equipment, unless otherwise noted.

D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Right of Way: Give to piping systems installed at a required slope.

G. Where underground ducts or conduit enter the building, the inside of the ducts or conduit shall be sealed with Duct-Sealing Compound.

H. Provide touch up paint as required on equipment finishes that have been scratched, and provide touch up paint as directed by the engineer. Touch-up paint shall be provided in accordance with the manufacturer's recommendations. Do not allow paint to come in contact with conductors, insulation or any live parts. All nameplates and labels shall remain visible and legible.

I. Overcurrent devices shall be readily accessible and shall be installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 6 feet 7 inches above the floor or working platform.

J. All exterior wall penetrations shall be made watertight. Seal inside and around conduit as required. The inside of the conduit shall be sealed with Duct-Sealing Compound.

K. Provide access doors where required to keep concealed electrical devices and equipment accessible in accordance with the National Electrical Code.

L. Unless otherwise noted, access doors shall be painted to match surrounding wall or ceiling.

M. Enclosures, troughs, wireways, boxes and raceways which contain unmetered wiring, shall be provided with a suitable means to accommodate the seals of the electric utility. Coordinate with electric utility and comply with their requirements.

N. Provide boards, channels, blocking, wall anchors, screws, hardware, and other supports for mounting electrical equipment on walls. Where the electrical equipment are mounted in finished spaces (including, but not limited to, offices, etc.), the supports shall be concealed. Where the electrical equipment are mounted in wet locations, the supports shall be suitable for wet locations.

O. Where electrical equipment are mounted above suspended ceilings, provide coordinate exact location of the equipment such that it does not block or prevent the removal/operation of ceiling tiles and access doors.

P. Where underground conduit enters buildings, and terminate at electrical equipment (including, but not limited to, panelboards, enclosed circuit breakers, lighting relay panels, etc.), the conduit shall terminate at the bottom of the electrical equipment, unless otherwise noted.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated ceiling, floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

B. Install UL Listed Firestopping Material in accordance with the manufacturer's recommendations, and UL's requirements.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. AWG: American Wire Gauge

B. KCMIL: Thousand Circular Mil

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation:

1. THHN/THWN-2 Wire:
   a. Complies with NEMA WC 70
   b. Listed to UL 83
   c. Suitable for operation at 600 volts or less in wet or dry locations.
   d. 90 degree C rated in wet or dry locations.
2. XHHW-2 Wire:
   a. Complies with NEMA WC 70
   b. Listed to UL 44
   c. Suitable for operation at 600 volts or less in wet or dry locations
   d. 90 degree C rated in wet or dry locations.
   e. Insulation is an abrasion, moisture, and heat resistant cross-linked polyethylene (XLP)

D. Branch Circuit Type Metal Clad Cable:

1. Conductor Insulation: THHN 90 degree C
2. Copper conductor.
3. Neutral wire shall be insulated and shall be the same size as the phase conductors.
4. Voltage Rating: 600V
5. Conductor covering: Polypropylene assembly tape overall
6. Armor: Interlocked galvanized steel
7. Fire Wall Rated for 1, 2 and 3 hour rated penetrations
8. Grounding Means: One insulated copper grounding conductor, unless otherwise noted.
9. Suitable for use in environmental air handling spaces
10. UL 1569 Listed

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. 600V Vinyl Insulating Tape: The tape is based on polyvinyl chloride (PVC) and/or its copolymers and has a rubber based, pressure-sensitive adhesive. The tape shall be 7 mils thick, and UL Listed and marked per UL Standard 510 as “Flame Retardant, Cold and Weather Resistant.”

D. Screw-on Pressure Cable Connector: Connector shall be UL Listed. Voltage rating shall be 600 volts for building wire and 1000 volts for signs and fixtures.

E. Mechanical Connector: Connector shall be UL Listed. Connector shall be wrapped with electrical insulating tape in accordance with the NEC and the manufacturer’s requirements. Connectors shall be dual rated (suitable for use with copper or aluminum conductors), unless otherwise noted.

F. Compression Connector: Connector shall be UL Listed. Connector shall be wrapped with electrical insulating tape in accordance with the NEC and the manufacturer’s requirements. Use compression tool recommended by manufacturer. Connectors shall be dual rated (suitable for use with copper or aluminum conductors), unless otherwise noted.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Service: Copper. Stranded.

B. Feeders: Copper. Stranded.

C. Branch Circuits: Copper.

1. Solid for No. 10 AWG and smaller, unless otherwise noted and except as follows:

a. Where the conductors connect to vibrating equipment (including, but not limited to, transformers, motors, and generators), the conductors shall be stranded.

b. Where the equipment manufacturer recommends stranded conductors, the associated conductors shall be stranded.

2. Stranded for No. 8 AWG and larger.

D. Class 1 and Class 2 Control Wiring: Copper. Stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Aboveground Service Entrance: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

B. Aboveground Exposed Feeders: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

C. Aboveground Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

D. Aboveground Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

E. Aboveground Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted and except as follows:

1. Branch Circuit Type Metal Clad Cable may be used in lieu of THHN/THWN-2, single conductors in raceway where ALL of the following conditions are met:
   a. Metal Clad Cable is fed from circuit breakers or fuses rated at 100 amperes or less.
   b. Metal Clad Cable is only used for branch circuit conductors.
   c. Metal Clad Cable is used only in dry locations.
   d. Metal Clad Cable is used only in aboveground applications.
   e. Metal Clad Cable is not subject to physical damage.
   f. Metal Clad Cable is used only in concealed ceilings, walls, and partitions.
   g. Metal Clad Cable is only used for final connections to the associated equipment.
   h. Metal Clad Cable does not exceed 6’ in length.
   i. Metal Clad Cable is installed only where allowed by the National Electrical Code, NFPA Codes, and Federal/State/Local Codes.

F. Aboveground Class 1 and Class 2 Control Wiring: Type THHN/THWN-2, single conductors in raceway unless otherwise noted.

G. Underground Service, Feeders and Branch Circuits: XHHW-2 single conductors in raceway, unless otherwise noted. The wiring shall be type XHHW-2 from end-to-end, regardless of whether or not the wiring starts or ends aboveground or underground. For example, a branch circuit for an underground lighting circuit shall be XHHW-2 from where the branch circuit starts (at the aboveground panelboard), up to where it ends (at the aboveground light pole).

H. Underground Class 1 and Class 2 Control Wiring: XHHW-2 single conductors in raceway, unless otherwise noted. The wiring shall be type XHHW-2 from end-to-end, regardless of whether or not the wiring starts or ends aboveground or underground. For example, a branch circuit for an underground lighting circuit shall be XHHW-2 from where the branch circuit starts (at the aboveground panelboard), up to where it ends (at the aboveground light pole).

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with the NEC.

B. Comply with the manufacturer’s recommendations and requirements.

C. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

G. Identify and color-code conductors and cables according to Specification Section "Electrical Identification."

H. Do not splice feeders and underground branch circuits unless specifically indicated in the drawings. Cables shall be unspliced between termination points.

I. Provide insulated bushings at the end of each Metal Clad Cable.

J. Use insulating bushings to protect ALL conductors, including conductors smaller than No. 4 AWG. Provide insulated grounding bushings where required by NFPA 70 or the Contract Documents.

K. Cables associated with roof mounted equipment or outdoor wall mounted equipment shall run concealed inside the building.

L. Spare wires shall be disconnected at both ends and shall be insulated at both ends with wire nuts held in place by electrical insulating tape. For large wire sizes, the spare wires shall be disconnected at both ends and shall be insulated at both ends with double wrapped electrical insulating tape.

M. Provide dedicated neutral wires for all branch circuits.

N. Do not combine separate feeder circuits in the same raceway, unless otherwise noted.

O. Do not combine separate branch circuits in the same raceway, unless otherwise noted and except as follows:
   1. Branch circuits may be combined in the same raceway where ALL of the following conditions are met:
      a. The branch circuits being combined in the same raceway serve the same area or adjacent areas.
      b. The branch circuits being combined in the same raceway homerun to the same panelboard.
      c. The number of branch circuits being combined in the same raceway does not exceed 3.
      d. The number of current carrying conductors installed in the same raceway does not exceed 6.
      e. The branch circuits are installed in a manner that does not subject them to any ampacity derating, except for the ampacity derating caused by having 4 to 6 current carrying conductors in the same raceway.
      f. The branch circuits that are being combined in the same raceway are all fed from 1-pole circuit breakers that have a trip rating of either 15 amperes or 20 amperes.
      g. The branch circuits that are being combined in the same raceway are not fed from circuit breakers that have a trip rating greater than 20 amperes.
      h. The branch circuits that are being combined in the same raceway are limited to 1-phase circuits that have a voltage of either 120V or 277V.
      i. The smallest wire size, in the branch circuits which are being combined in the same raceway, is not smaller than #12 AWG.
      j. The wires that are combined in the same raceway do not exceed the NEC wire fill capacity of the raceway. The raceway size is increased as required to comply with NEC requirements.
      k. The branch circuits which are being combined in the same raceway are limited to lighting and receptacle branch circuits.

l. Dedicated neutral wires are provided for all branch circuits.
m. Ground wires are provided in accordance with NEC requirements. Grounding and bonding are provided in accordance with NEC requirements.
n. Where the NEC does not allow branch circuits to be combined in the same raceway, the branch circuits are not combined in the same raceway.
o. All work complies with the NEC, the manufacturer's recommendations, and the contract documents.

P. All metal clad cable shall be concealed, unless otherwise noted.

Q. Underground splices of service, feeder, and branch circuits shall not be permitted, unless otherwise noted.

R. Where wires larger than #10 AWG are installed on 15A or 20A branch circuits, splice #10AWG "pigtails" for connections to circuit breakers, devices and equipment. "Pigtails" in this paragraph shall mean short leads used to connect a circuit breaker, device or equipment to branch circuit wires. Comply with all of the following:
1. Length of the wires of the "pigtails" shall be less than 48", unless otherwise noted and except as follows:
a. At light poles, the length of the "pigtails" shall be increased to match the height of the light pole such that the "pigtail" splice is located in the handhole at the base of the pole. The length of the "pigtail" shall not exceed 125% of the overall height of the light pole.
2. Where the "pigtails" are run inside raceways, the length of the raceways shall be less than 23", and the raceways shall be sized per NEC requirements.
3. Provide junction boxes as required for splicing wires.
4. The wire size of the phase, neutral, and ground wires of the "pigtails" shall not be less than #10AWG, except as follows:
a. The wire size of the phase, neutral and ground wires of the "pigtails" shall be #12AWG where the wire terminals at the circuit breaker, device, or equipment are not suitable for wires larger than #12AWG.
5. All work shall comply with NEC, the manufacturer's recommendations, and the contract documents.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Engage a qualified testing agency and perform the following tests and inspections, and prepare test reports:
a. Perform each visual and mechanical inspection and electrical test stated in the NETA Acceptance Testing Specification. Certify compliance with test parameters.

1) Electrical tests (this includes, but is not limited to: insulation resistance testing) are required on all wiring that is #2 AWG and larger, and all sizes of underground wiring. Visual and mechanical inspections are required on all wiring.

2. The testing agency shall coordinate with the manufacturer of the item being tested, and shall obtain copies of the installation/testing manuals. The testing agency shall not exceed the test voltage/current/duration limits indicated by the manufacturer.
3. Remove and replace items which do not pass the tests. Test the replacement items.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise noted.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 foot long.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller (exception: conductors for vibrating equipment, such as transformers, motors and generators, shall use stranded conductors; or, where stranded conductors are recommended by the manufacturer of the equipment, use stranded conductors), and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.
3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits. This includes, but is not limited to, low and medium voltage feeders and branch circuits.

B. Unless otherwise noted, all equipment grounding conductors shall be insulated.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 70, NFPA 780 and UL 96 when interconnecting with lightning protection system.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts.

E. Ground cable shielding, metallic conduits, wireways, cable boxes, luminaires, light poles, electrical equipment housings, and all noncurrent carrying metallic parts.

F. All metal conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings, bonded together, bonded to the enclosure, and bonded to the enclosure ground bus/terminal.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. RMC: Rigid metal conduit.

B. MFMA: Metal Framing Manufacturer's Association

C. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. Thomas & Betts Corporation.
e. Unistrut; Tyco International, Ltd.
f. Hilti

2. Comply with the following for Outdoor Locations, unless otherwise noted:
a. Steel Channel Metallic Coatings: Hot-dip galvanized after fabrication in accordance with ASTM A123 and applied according to MFMA-4.
b. Fittings and Accessories:
1) Conduit hangers, conduit clamps, beam clamps, and wall brackets shall be steel, hot-dip galvanized after fabrication in accordance with ASTM A123.
2) Threaded hardware such as mechanical expansion anchors, nuts, bolts, and threaded rods shall be steel, hot-dip galvanized after fabrication in accordance with ASTM A123. Threaded hardware not available as hot-dip galvanized after fabrication shall be stainless steel type 304.

3. Comply with the following for Indoor Locations, unless otherwise noted:
a. Steel Channel metallic Coatings: Pre-Galvanized Steel with mill galvanized coating designation G90.
b. Fittings and Accessories:
1) Conduit hangers, conduit clamps, beam clamps, and wall brackets shall be pre-galvanized (designation G90) or electroplated zinc (ASTM B633).
2) Threaded hardware shall be electroplated zinc (ASTM B633).

4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

E. The use of powder-actuated tools is not allowed.

F. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

G. Do not use spring steel clips and clamps.

H. In wet or damp locations, use steel channel supports to standoff non-recessed, wall mounted cabinets and panelboards, at least one inch from the mounting surface.

I. Where electrical equipment (including, but not limited to, lighting fixtures, wiring, conduit, etc.), or the items to which the electrical equipment are attached to or supported from (including, but not limited to, metal channels, junction boxes, etc.), are suspended, and the vertical length of the supports (including, but not limited to, threaded rods) for these equipment/items are longer than 48 inches, provide bracing supports to prevent swinging of the equipment/items.

J. Suspended electrical equipment (including, but not limited to, lighting fixtures, wiring, conduit, etc.) shall be supported from the building structure. Where suspended electrical equipment are not located directly under roof trusses, roof supports, or other structural elements, or where other equipment (mechanical, plumbing, etc.) are located above the electrical equipment, provide metal channels and other supports to span, or attach to, the roof trusses, roof supports, or other structural elements. The electrical equipment shall be installed at the locations indicated in the Contract Documents, and metal channels and other supports shall be provided as required in order to support the electrical equipment.

K. Provide supports for conductors in vertical conduit in accordance with the manufacturer’s recommendations and NEC requirements.

L. Where racks or cabinets are wall mounted, provide metal channels or fire-retardant plywood boards that are capable of supporting the equipment mounted on it, to span and attach to the wall studs, wall columns, or other wall elements. Where the wall elements cannot support the racks or cabinets, provide independent freestanding supports for the racks or cabinets. The metal channels, boards, and supports shall be painted to match adjacent wall surfaces where installed in finished spaces (including, but not limited to, offices, conference rooms, etc.)

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3500-psi, 28-day compressive-strength concrete, unless otherwise indicated.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

D. Concrete Pad Protection and Curing:
1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Cure concrete for at least 28 days

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. FMC: Flexible metal conduit.

B. LFMC: Liquidtight flexible metal conduit.

C. RNC: Rigid nonmetallic conduit.

D. EMT: Electrical metallic tubing.

E. Where RGS (Rigid Galvanized Steel) Conduit, GRS (Galvanized Rigid Steel) Conduit, or RMC (Rigid Metal Conduit) are indicated in the contract documents, this shall mean Rigid Steel Conduit.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.

4. O-Z Gedney; a unit of General Signal.
5. Wheatland Tube Company.
6. Robroy Industries Electrical Products Division

B. Rigid Steel Conduit:
1. Manufactured in accordance with ANSI C80.1.
2. UL 6 Listed

C. FMC:
1. UL 1 Listed. UL Type RW (Reduced Wall)
2. Zinc-coated steel construction

D. EMT:
1. Manufactured in accordance with ANSI C80.3
2. UL 797 listed
3. Fittings: Set-screw or Compression type.

E. LFMC:
1. UL 360 Listed
2. Flexible steel conduit with PVC jacket.
3. PVC jacket shall be moisture, oil and sunlight resistant.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), and Cable: NEMA FB 1; UL listed for type and size raceway with which used, and for application and environment in which installed.
1. Insulating Bushings: Plastic, 105 degree C minimum temperature rating.
2. Insulated Grounding Bushings: Malleable Iron with plastic liner, 105 degree C minimum temperature rating.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. CANTEX Inc.
4. Condux International, Inc.
5. Electri-Flex Co.
6. Lamson & Sessions; Carlon Electrical Products.
7. RACO; a Hubbell Company.
8. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-40-PVC (PVC Schedule 40) and Type EPC-80-PVC (PVC Schedule 80), UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. RNC shall be sunlight resistant and rated for use with 90 degree C conductors.

2.3 METAL TROUGHS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Covers: Screw-cover type, unless otherwise noted

D. Finish: ANSI 61 gray polyester powder paint finish inside and out over phosphatized surfaces.

2.4 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type, unless otherwise noted

E. Finish: ANSI 61 gray polyester powder paint finish inside and out over phosphatized surfaces.

2.5 ROOFTOP SUPPORTS FOR CONDUIT

A. Where conduit is mounted on top of flat rooftops, provide B-LINE DURA-BLOK rooftop supports to support the conduit. The rooftop supports shall have the following features:
1. Overall height of the support shall not be less than 5”.
   a. The clearance from the bottom of the conduit to the top of the roof shall not be less than 5”.
2. Built-in metal channel
3. Load capacity shall be selected to provide a minimum of 5 times safety factor
4. Made from 100% recycled rubber
5. Reflective strip on both sides allow for easy product visibility
6. Channel is through bolted on all sides for added strength
7. Product composition is not sharp or abrasive
8. UV resistant
9. Suitable for any type of roofing material or other flat surface.

2.6 FLOOR BOXES

A. Three-Compartment Floor Box shall include, but not be limited to the following components indicated below (provide additional hardware, accessories, and devices for a complete and fully operational floor box system):

1. Cast-iron Floor Box: Provide Wiremold 880CM3-1 three-gang shallow cast iron floor box, fully adjustable, or approved equal with the following features:
   a. A divider shall be provided to separate the three compartments.
   b. Dimension 5 3/16" x 12 ½" x 2 7/16".
   c. Conduit Openings: (8) 1"
2. Cover Plate Flange: Provide Wiremold 837B three-gang, brass combination carpet and tile flange or approved equal with the following features:
   a. Suitable for receptacle and telephone/data outlets
   b. Suitable for carpet, tile or concrete floor applications
3. The floor box shall have the following features:
   a. Floor box shall have TopGuard protection (an integral design which keeps out water, dirt, and debris from the power and communication compartments).
   b. Fully adjustable box. Before and after concrete pour adjustability.
   c. Concrete tight cast-iron constructions. Meets requirements for on grade or below grade application.
   d. Suitable for use in carpets, tiles or concrete floors.
   e. Complies with UL Scrub Water Standards.
   f. Water shall not enter power outlets during routine wet mopping and carpet shampooing.
   g. Suitable for installation in concrete floors.
4. Comply with the following for compartments with duplex receptacles:
   a. Coverplate shall be Wiremold 828R brass duplex cover plate or approved equal. Provide faceplate, modules, adapters, and other accessories as required for the installation of the receptacle.
5. Comply with the following for compartments with telephone/data/audio visual outlets:
   a. Coverplate shall be Wiremold 828GFITC brass cover plate or approved equal. Provide faceplate, modules, adapters, inserts, and other accessories as required for installation of the telephone/data/coax/HDMI jacks.
6. Provide all associated mounting hardware and accessories.

B. Two-Compartment Floor Box shall include, but not be limited to the following components indicated below (provide additional hardware, accessories, and devices for a complete and fully operational floor box system):
   1. Cast-iron Floor Box: Provide Wiremold 880CM2-1 two-gang shallow cast iron floor box, fully adjustable, or approved equal with the following features:
      a. A divider shall be provided to separate the two compartments.
      b. Dimension 5 3/16" x 8 ½" x 2 7/16".
      c. Conduit Openings: (6) 1"
   2. Cover Plate Flange: Provide Wiremold 827B two-gang, brass combination carpet and tile flange or approved equal with the following features:
      a. Suitable for receptacle and telephone/data outlets
      b. Suitable for carpet, tile or concrete floor applications
   3. The floor box shall have the following features:
      a. Floor box shall have TopGuard protection (an integral design which keeps out water, dirt, and debris from the power and communication compartments).
      b. Fully adjustable box. Before and after concrete pour adjustability.
      c. Concrete tight cast-iron constructions. Meets requirements for on grade or below grade application.
      d. Suitable for use in carpets, tiles or concrete floors.
      e. Complies with UL Scrub Water Standards.
      f. Water shall not enter power outlets during routine wet mopping and carpet shampooing.
      g. Suitable for installation in concrete floors.
   4. Comply with the following for compartments with duplex receptacles:

a. Coverplate shall be Wiremold 828R brass duplex cover plate or approved equal. Provide faceplate, modules, adapters, and other accessories as required for the installation of the receptacle.

5. Comply with the following for compartments with telephone/data/audio visual outlets:
   a. Coverplate shall be Wiremold 828GFITC brass cover plate or approved equal. Provide faceplate, modules, adapters, inserts, and other accessories as required for installation of the telephone/data/coax/HDMI jacks.
6. Provide all associated mounting hardware and accessories.

2.7 BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Hoffman.
4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
5. O-Z/Gedney; a unit of General Signal.
6. RACO; a Hubbell Company.
7. Robroy Industries, Inc.; Enclosure Division.
8. Spring City Electrical Manufacturing Company.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.8 ENCLOSURES AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hoffman.

B. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

C. Metal Enclosures: Steel, finished inside and out with manufacturer’s standard enamel.

2.9 CORROSION PROTECTION TAPE

A. Corrosion protection tape shall be 3M Scotchrap Tape 51 or approved equal with the following features:

1. Tape is a tough, polyvinyl chloride based tape with special high tack adhesives formulated to resist corrosion of metal piping systems above and below ground, fittings, and joints on all mill-coated pipe and electrical conduit systems.

2. Tape is resistant to corrosive salt water, soil acids, alkalies and salts, common chemicals, chemical vapors, and exposure to outdoor weathering and sunlight.

3. Tape is resistant to impact, abrasions, punctures and tears.

4. Tape is 20 mil thick.

5. Tape is suitable for -55 to 175 degree F service temperatures

6. Tape shall be compatible with the conduit.

B. Where the tape manufacturer recommends that a primer be used with the tape, provide a primer that is recommended by the manufacturer. The primer shall be manufactured by the same manufacturer as the tape. For the 3M Scotchrap Tape 51, use 3M Scotchrap Pipe Primer, unless the manufacturer recommends a different primer for the application. The primer shall be compatible with the tape and the conduit.

C. Where the tape manufacturer recommends that putty be used with the tape, provide putty that is recommended by the manufacturer. The putty shall be manufactured by the same manufacturer as the tape. For the 3M Scotchrap Tape 51, use 3M Scotchfil Electrical Insulation Putty, unless the manufacturer recommends a different putty for the application. The putty shall be compatible with the tape and the conduit.

PART 3 - EXECUTION

3.1 RACEWAY AND BOXES APPLICATION

A. Indoor locations:
   1. Raceway shall be EMT, unless otherwise noted and except as follows:
      a. Where raceway is used for supporting lighting fixtures, lighting control devices, occupancy sensors, photo sensors, wiring devices, receptacles, and other electrical equipment, the raceway shall be Rigid Steel Conduit, unless otherwise noted.
      b. Use Rigid Steel Conduit in damp or wet locations, unless otherwise noted.
      c. Conduit Larger than 4-inch trade size shall be Rigid Steel Conduit.
      d. Where raceway is subject to physical damage, use Rigid Steel Conduit, unless otherwise noted.
      e. For raceway embedded within a concrete/masonry wall or floor slab, use Rigid Steel Conduit, unless otherwise noted.
      f. Use FMC for connection to vibrating equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment), and for connection to equipment where the manufacturer recommends a flexible raceway, unless otherwise noted and except as follows:
         1) Use LFMC for damp or wet locations.
         2) Use LFMC where LFMC is recommended by the manufacturer of the equipment.
   2. Boxes and enclosures shall be NEMA 1, galvanized steel, unless otherwise noted, and except as follows:

a. Boxes and enclosures in damp or wet locations shall be NEMA 3R, die cast aluminum, gasketed covers, unless otherwise noted and except as follows:
1) Boxes and enclosures in shower rooms shall be NEMA 4X stainless steel type 304, unless otherwise noted.

B. Outdoor locations: Apply raceway and boxes products as specified below, unless otherwise noted:
1. Raceway shall be Rigid Steel Conduit, unless otherwise noted and except as follows:
a. For underground raceway (including, but not limited to, raceway below the bottom of the lowest floor slab of the building/structure), use PVC Schedule 40 conduit, unless otherwise noted.
b. Use LFMC for connection to vibrating equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment), and for connection to equipment where the manufacturer recommends a flexible raceway, unless otherwise noted.
2. Boxes and enclosures shall be NEMA 3R, die cast aluminum, gasketed covers, unless otherwise noted.

C. Wireways and Troughs: All Wireways and Troughs shall be metal, with ANSI 61 gray polyester powder paint finish inside and out over phosphatized surfaces, unless otherwise noted.

D. Minimum Raceway Size: 3/4-inch trade size, unless otherwise noted.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise noted.

3.2 INSTALLATION

A. Transitions from PVC conduit that is located underground (including, but not limited to, conduit below the bottom of the lowest floor slab of the building/structure), to aboveground metal conduit:
1. Where the conduit is coming through the floor, an equipment pad, or finished grade, comply with the following:
a. Change from PVC conduit to Rigid Steel Conduit 12” below the top of the floor/pad/grade, and continue with Rigid Steel Conduit up to 24” above the finished floor or grade, or up to the equipment which the conduit connects to, whichever is lower, unless otherwise noted. Above 24” or above the equipment, use the raceway specified in the RACEWAY AND BOXES APPLICATION paragraph of this Specification Section, unless otherwise noted. Metal conduit shall be grounded and bonded in accordance with the NEC.
b. Exceptions:
1) Where the PVC conduit turns up under freestanding, floor or concrete pad mounted, electrical equipment that completely enclosed and conceal the conduit, such as pad mounted switchboards/switchgear, the conduit shall be PVC conduit from underground up to where the conduit stops aboveground.
2) The conduit shall be PVC conduit from below floor or grade up to where the conduit stops at the following locations:
a) Outdoors, where PVC conduit turns up at the utility transformer.
b) Outdoors, where PVC conduit turns up at the utility poles
c) Indoors, where PVC conduit from the utility poles or utility manholes, containing telephone, cable tv and fiber internet service cables, turns up at the telephone terminal board in the electrical/telecom room.

B. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Raceway Terminations: Use insulating bushings to protect ALL conductors, including conductors smaller than No. 4 AWG. Provide insulated grounding bushings where required by NFPA 70 or the Contract Documents.

G. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

H. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

I. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors. Comply with the following:

1. Use LFMC where required by the Contract Documents.

J. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

K. Raceway shall run parallel or perpendicular to wall and ceiling structures (columns, joists, support beams, etc.) for a neat appearance.

L. All metallic raceways, boxes and enclosures shall be grounded.

M. Provide watertight hubs for all junction boxes and enclosures installed outdoors or in wet locations. Hubs used with NEMA 3R junction boxes and enclosures shall be NEMA 3R or NEMA 4X rated. Hubs used with NEMA 4 or 4X junction boxes and enclosures shall be NEMA 4X rated.

N. Underground raceway shall be made watertight.

O. Provide reducers as required to match the conduit size with the hub or conduit entry on the junction box or equipment. Install reducers in accordance with the manufacturer's recommendations and NEC requirements.

1. Where there are no available reducers in the sizes required, provide an interposing junction box between the larger conduit and the smaller hub or conduit entry, then provide a smaller conduit from the junction box to the hub or conduit entry. The size of the smaller conduit shall be the largest that can fit at the hub or conduit entry. Length of smaller conduit shall be less than 24". Do not exceed the conduit fill requirements

indicated in the NEC. All work shall comply with the manufacturer's recommendations and NEC requirements.

P. Bending radius of conduit shall be selected to minimize wire or cable pulling tensions. Do not exceed the maximum pulling tension of the wire or cable manufacturer. Coordinate with wire or cable manufacturer.

Q. Raceway associated with roof or canopy mounted equipment shall run concealed under the roof or canopy.

R. Raceway associated with indoor or outdoor wall mounted equipment shall be concealed.

S. Where raceway is installed above the roof, the distance from the roof to the bottom of the raceway shall not be less than 4 inches. Provide mounting and supporting devices as required.

T. Floor Box Installation
1. Furnish and install floor box in accordance with the manufacturer's recommendation and NEC requirements.
2. Provide accessories as required for a complete installation.
3. Close unused raceway openings using the manufacturer's recommended accessories.
4. Coordinate floor box installation with the construction of the floor. Coordinate exact location of floor box with the owner/architect/engineer prior to installation.

U. Where the voltage between adjacent switches, receptacles or similar devices, in the same junction box or enclosure is 300V or greater, provide an internal securely installed barrier between the adjacent switches. Comply with NEC requirements.

V. All raceway shall be concealed, unless otherwise noted and except as follows:
1. Raceway may be exposed in electrical and mechanical rooms.

W. For surface mounted panelboards which are not located within electrical and mechanical rooms, the raceway from the finished floor to the bottom of the panelboard, and from the top of the panelboard to the ceilings space, shall be enclosed in a 3-sided trough that is 12 gauge steel minimum, and is painted to match the adjacent wall. The width and depth of the trough shall match the dimensions of the panelboards. The trough shall not prevent access/removal of the panelboard covers/doors.

X. Raceways/boxes and associated electrical equipment shall not block or impede the movement/operation of equipment that move (including, but not limited to, overhead doors, sliding doors, etc.).

Y. Provide corrosion protection tape on all metal conduit (including, but not limited to, empty/spare conduit, conduit that have wiring within, conduit used as support posts, etc.) that is in contact with earth, soil, or concrete. Provide corrosion protection tape on all metal conduit that is located underground. Provide primer and putty in accordance with the recommendations of the tape manufacturer. Tape, primer, and putty shall be installed in a manner which does not reduce the electrical continuity of the electrical conduit system. All work shall comply with the requirements of the manufacturer, the NEC, and the AHJ.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260540 - UNDERGROUND DUCTS AND UTILITY STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

B. OSHA: Occupational Safety and Health Administration

C. Duct: Conduit that are suitable for use underground

D. Ductbank: Two or more ducts

E. Direct buried duct: Duct that is buried in the ground, without any concrete encasement

F. Direct buried ductbank: Ductbank that is buried in the ground, without any concrete encasement

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

1.7 COORDINATION

A. Coordinate elevation, layout and installation of ducts with final arrangement of other utilities, site grading, and surface features as determined in the field.

PART 2 - PRODUCTS

2.1 CONDUIT

A. RNC: NEMA TC 2, Type EPC-40-PVC (PVC Schedule 40) and Type EPC-80-PVC (PVC Schedule 80), UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. RNC shall be sunlight resistant and rated for use with 90 degree C conductors.

2.2 DUCT ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cantex, Inc.
2. Condux International, Inc.
3. Lamson & Sessions; Carlon Electrical Products.
4. Manhattan/CDT; a division of Cable Design Technologies.
5. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Specification Section "Electrical Identification."

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Polymer Concrete Handhole:

1. Enclosures, boxes, and covers shall conform to all test provisions of the most current ANSI/SCTE 77 “Specification For Underground Enclosure Integrity” for Tier 22 applications. All covers are required to have the Tier level rating embossed on the surface. In no assembly can the cover design load exceed the design load of the box.

2. Handhole shall be tested by UL to meet the requirements of ANSI/SCTE 77. Handhole shall be UL Listed.

3. Handhole shall have an open bottom, unless otherwise noted.

4. Handhole design load (including box and cover) shall be 22,500 pounds.

5. Handhole cover shall be secured to the box with stainless steel bolts.

6. Handhole shall be manufactured by Quazite or approved equal. See drawings for dimensions of handhole.

PART 3 - EXECUTION

3.1 DUCT APPLICATION

A. Direct-buried ducts: Duct shall be NEMA TC 2, Type EPC-40-PVC (PVC Schedule 40), unless otherwise noted on the drawings.

B. Concrete encased ducts: Duct shall be NEMA TC 2, Type EPC-40-PVC (PVC Schedule 40), unless otherwise noted on the drawings.

3.2 EARTHWORK

A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Cut and patch existing streets, roads, driveways, parking lots, and paved areas in the path of underground ducts and utility structures. Repair existing streets, roads, driveways, parking lots, and paved areas after underground ducts and utility structures have been constructed/installed. The repaired streets, roads, driveways, parking lots, and paved areas shall match the adjacent streets, roads, driveways, parking lots, and paved areas.

E. Remove, re-install and repair as required, existing fences, sign posts, walls or structures that are in the path of underground ducts and utility structures.

3.3 DUCT INSTALLATION

A. Burial Depth:
   1. Direct buried duct or ductbanks: All direct buried duct or ductbanks shall have a minimum of 36” of cover from the top of the duct or ductbank to finished grade, unless otherwise noted on the drawings.
   2. Concrete encased ducts or ductbanks: All concrete encased duct or ductbanks shall have a minimum of 36” of cover from the top of the duct or ductbank to finished grade, unless otherwise noted on the drawings.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes or handholes to drain in both directions.

C. Where new ducts/ductbanks cross existing underground utilities, comply with the minimum cover requirements and minimum separation requirements indicated in the contract documents. Provide supports under the new ducts/ductbanks and existing underground utilities as required. The new duct/ductbanks shall be installed below the existing underground utilities, unless otherwise noted and except as follows:
   1. The new duct/ductbanks may be installed above the existing underground utilities where ALL of the following conditions are met:

a. Where it is installed, the new duct/ductbanks comply with the minimum cover requirements and minimum separation requirements indicated in the contract documents.
b. Adequate supports are provided for the new duct/ductbanks such that it does not add weight onto the existing underground utilities.
c. There will be no damage to the existing underground utilities.

D. Where new ducts/ductbanks cross other new ducts/ductbanks, comply with the minimum cover requirements and minimum separation requirements in the contract documents. The new ducts/ductbanks shall be installed above and below each other as required to comply with the minimum cover requirements and minimum separation requirements indicated in the contract documents. Provide supports under the new ducts/ductbanks as required.

E. Do not damage existing underground utilities and structures. Any damage caused by the contractor to existing underground utilities and structures shall be repaired by the contractor at no cost to the owner.

F. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends, both horizontally and vertically, at other locations, unless otherwise noted.

G. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

H. Provide duct sealing compound where underground ducts and ductbanks stub up at utility poles/transformers and where underground ducts and ductbanks enter buildings. Duct sealing compound shall provide a watertight seal inside the ducts and ductbanks. Where duct sealing compound is in contact with wiring that is furnished and/or installed by the utility company, product data of the duct sealing compound shall be submitted to the utility company for their review/approval prior to its use.

I. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

J. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
1. Provide pulling cord in all unused or spare ducts.

K. Duct Entrances to Manholes and Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
2. Grout end bells into structure walls from both sides to provide watertight entrances.

L. Building Wall Penetrations: Install conduit penetrations of building walls as specified in Specification Section "Common Work Results for Electrical."

M. Concrete-Encased Ducts:
1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature. Where there are multiple sizes of conduit in a ductbank, provide spacers and spacer accessories to accommodate the conduit.
2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and

to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

3. Excavate trench bottom to provide firm and uniform support for ducts.
4. Place and compact bedding course on trench bottoms. Use satisfactory soil, free of particles larger than 1 inch in any direction, as the compact bedding course. Depth of bedding course shall be not less than 6”.
5. Concreting Sequence: Pour each run of envelope between manholes, handholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

6. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
7. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
8. Comply with all of the following separation requirements, unless otherwise noted:
    a. Provide a minimum of 12” separation between 600V power or communications ducts and foreign structures (including, but not limited to, gas, water, sanitary and oil pipes).
    b. Provide a minimum of 12” separation between 600V power or communications ducts and medium voltage (>600V) duct/wiring.
    c. Provide a minimum of 6” separation between 600V power ducts and communications (including, but not limited to, telephone and cable tv) ducts.
    d. Provide a minimum of 3” separation between 600V power ducts and other 600V power ducts.
    e. Provide a minimum of 3” separation between communication ducts and other communication ducts.
    f. Comply with the minimum separation requirements of the Utility Companies. Coordinate with the Utility Companies as required.
9. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
10. Warning Tape: Bury warning tape above all concrete-encased ducts. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 36 inches. Space additional tapes 12 inches apart, horizontally. Depth of warning tape shall be 12” below finished grade.

N. Direct-Buried Ducts:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature. Where there are multiple sizes of conduit in a ductbank, provide spacers and spacer accessories to accommodate the conduit.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for ducts.
4. Place and compact bedding course on trench bottoms. Use satisfactory soil, free of particles larger than 1 inch in any direction, as the compact bedding course. Depth of bedding course shall be not less than 6".
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.
6. Comply with all of the following separation requirements, unless otherwise noted:
    a. Provide a minimum of 12" separation between 600V power or communications ducts and foreign structures (including, but not limited to, gas, water, sanitary and oil pipes).
    b. Provide a minimum of 12" separation between 600V power or communications ducts and medium voltage (>600V) duct/wiring.
    c. Provide a minimum of 12" separation between 600V power ducts and communications (including, but not limited to, telephone and cable tv) ducts.
    d. Provide a minimum of 3" separation between 600V power ducts and other 600V power ducts.
    e. Provide a minimum of 3" separation between communication ducts and other communication ducts.
    f. Comply with the minimum separation requirements of the Utility Companies. Coordinate with the Utility Companies as required.
7. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated.
8. Warning Tape: Bury warning tape above all direct buried ducts. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 36 inches. Space additional tapes 12 inches apart, horizontally. Depth of warning tape shall be 12" below finished grade.
9. Concrete encasement at bends and 90 degree elbows: All bends and 90 degree elbows shall be concrete encased with a minimum of 3" thick of 3000 psi concrete at 28 days.

O. Provide underground-line warning tape above all direct buried and concrete encased ducts.

P. Excavation for Utility Trenches:

1. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of ducts and ductbanks.

Q. Utility Trench Backfill:

1. Place backfill on subgrades free of mud, frost, snow, or ice.
2. Backfill material shall be free of particles larger than 1 inch in any dimension.
3. Carefully compact initial backfill under conduit haunches and compact evenly up on both sides and along the full length of conduit to avoid damage or displacement of conduit.
4. Backfill voids while installing and removing shoring and bracing.
5. Backfill in layers not more than 4 inches for material compacted by hand operated tampers.

6. Compact soil material to not less than the following percentage of maximum dry unit weight according to ASTM D698:
   a. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

R. Ducts and ductbanks shall be made watertight.

S. Bending radius of ducts shall be selected to minimize wire or cable pulling tensions. Do not exceed the maximum pulling tension of the wire or cable manufacturer. Coordinate with wire or cable manufacturer.

T. Provide pull wires in all empty ducts.

U. Underground conduit, ducts, or ductbanks shall not be installed under concrete footings, piers, or other load bearing structures of the building. Additionally, these items shall not be located within a 45 degree zone that extends downwards and outwards from the bottom outer edge of the load bearing structures.

V. Where ducts run under bollards or the outside perimeter of the building, comply with the following:
   1. Increase the depth of the ducts to provide a minimum of 12” clearance between the top of the ducts and the bottom of the bollard or the outside perimeter of the building.
   2. For Direct-Buried Ducts: Provide concrete encasement. Concrete encasement shall be a minimum of 3” thick on the sides, and 12” thick at the top and bottom, of the ducts. Concrete encasement shall extend a minimum of 3’ before and after the bollard or the outside perimeter of building. Concrete shall be 3000 PSI at 28 days.
   3. For Concrete-Encased Ducts: Increase the thickness of the concrete encasement to a minimum of 12” thick at the top and bottom. Concrete encasement shall extend a minimum of 3’ before and after the bollard or the outside perimeter of building. Concrete shall be 3000 PSI at 28 days.

W. Where the burial depth of a duct is indicated in the Contract Documents, the indicated depth is the shortest distance measured between a point on the top surface of the duct, and the top surface of finished grade, concrete, or similar cover.

X. Where an underground duct penetrates an exterior wall below grade, and enters a room that is located below grade, the wall penetration shall not be located above any electrical equipment, unless otherwise noted.

3.4 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support handhole/box on a level bed of crushed stone or gravel, 6” deep minimum, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth. Where the handhole/box manufacturer requires a different type of stone/gravel, or requires a greater depth of stone/gravel, comply with the manufacturer’s recommendations.

C. Elevation: Cover surface will be flush with finished floor or finished grade.

D. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

E. For solid bottom handholes, provide a 1” diameter hole at the bottom of the handhole, to allow water to drain through.

F. Install handholes and boxes in accordance with the manufacturer’s recommendations, so that the installed handholes and boxes comply with the load ratings required by the contract documents.

3.5 TEST PIT EXCAVATION

A. Provide test pits where the new underground ducts will cross with the location of the existing underground utilities and structures. Coordinate location of underground ducts, utilities and structures with the plans, the drawings provided by the utility locator contractor, and field conditions.

B. The test pits shall be used to determine the depth of existing underground utilities and structures where these utilities and structures are located within the depth of the test pits.

C. Depth of test pit shall be as required to determine there is no conflict between the new and existing underground ducts, utilities and structures. Minimum depth and separation requirements for the new underground ducts are indicated in the contract documents.

D. Upon completion, the test pit shall be backfilled, compacted, repaired, and the site returned to the original condition.

E. Perform test pit excavation prior to installing underground conduit, manholes/handholes or other underground structures.

F. Any damage to existing underground utilities and structures due to the test pit excavation shall be repaired by the contractor at no cost to the owner.

G. Coordinate depth and routing of ductbank with the results of the field investigation.

3.6 LOCATING EXISTING UNDERGROUND UTILITIES

A. The drawings do not show all the existing underground utilities. Also, the existing underground utilities shown on the drawings are shown in their approximate locations only. The contractor is responsible for determining the existing underground utilities and their exact location for the areas where he will be working.

B. Before starting any work, hire the services of a Utility Locator contractor to determine the locations of existing underground utilities in the following areas:
1. Where underground ducts are being installed
2. Where concrete foundations are being installed for various equipment
3. Where any underground equipment or structures are being installed
4. Where light poles and light bollards are being installed
5. Where handholes and manholes are being installed
6. Where the existing grade is being lowered

C. Location of existing underground utilities shall be marked up on the drawings.

D. The location of existing underground utilities shall be marked on the ground in the field.

E. Coordinate depth and routing of ductbank with the results of the field investigation.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes and handholes, including sump. Remove foreign material.

C. Do not damage the ducts during cleaning.

END OF SECTION 260540

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SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Instrumentation and Control Circuits: Black letters on a yellow field.
3. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

2.5 INSTRUCTION SIGNS

A. Self-Adhesive Instruction Signs: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Phenolic Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For conductors No. 4/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

C. Locations of Underground Lines: Provide underground-line warning tape for direct buried and concrete encased ducts or ductbanks.

D. All receptacles, starters, disconnects, and drop cords (receptacles and lights) shall be labeled with its associated circuit number.

E. All panelboards shall be labeled with the circuit number associated with the feeder breaker that supplies power to it.

F. All equipment with integral disconnects shall be labeled with its associated circuit number.

G. All fire alarm control panels and fire alarm remote booster power supplies shall be labeled with its associated circuit number.

H. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
2. Provide a sign/label on panelboards, receptacles, controller and other equipment that are fed from the generator as follows: “FED FROM GENERATOR THRU ATS-xxx”, where xxx is the label of the transfer switch.
3. Provide a “BUILDING FEEDER DISCONNECT” label for each building feeder disconnect at the building. Source of feeder shall also be indicated.
4. Where the removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating: SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THIS EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCES(S) IS ENERGIZED.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Adhesive film label with clear protective overlay

2. Equipment to be labeled includes, but is not limited to, the following:

    a. All power distribution equipment (including, but not limited to, panelboards, disconnects, breakers, transformers, electrical cabinets/enclosures, etc.)

3.2 INSTALLATION

A. Verify the identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V and 240/120V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
    d. Neutral: White

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 36 inches overall.

END OF SECTION 260553

SECTION 260573 - POWER SYSTEMS ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.
4. Arc-Flash Hazard Analysis

E. Coordination study shall be submitted at the same time as the submittals for the power distribution equipment.

F. Coordination study shall be sealed and signed by a Professional Electrical Engineer that is licensed in the State of Maryland.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.1 APPLICATION

A. Provide Fault-Current Study, Coordination Study, Overcurrent Protective Device Setting, and Arc Flash Hazard Analysis for the following:
1. All new power distribution equipment

B. Provide Arc-flash labels on all new power distribution equipment included in the Arc Flash Hazard Analysis.

C. The contractor shall obtain the latest fault current information from the Electric Utility. The fault current information shall be used in the studies.

3.2 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

B. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices not submitted for approval with coordination study may not be used in study.

3.3 FAULT-CURRENT STUDY

A. Contractor shall coordinate with the electric utility and get the available fault current from the electric utility. Use the actual available fault current from the utility.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project and use approved computer software program to calculate values. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with the following:

1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.50.
2. Low-Voltage Fuses: IEEE C37.46.
3. Circuit Breakers: IEEE C37.13.

E. Study Report: Enter calculated X/R ratios and interrupting (5-cycle) fault currents on electrical distribution system diagram of the report. List other output values from computer analysis, including momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault-current values for 3-phase, 2-phase, and phase-to-ground faults.

F. Equipment Evaluation Report: Prepare a report on the adequacy of overcurrent protective devices and conductors by comparing fault-current ratings of these devices with calculated fault-current momentary and interrupting duties.

3.4 COORDINATION STUDY

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical distribution system diagram showing the following:

    a. Load current that is the basis for sizing continuous ratings of circuits for cables and equipment.
    b. Circuit-breaker and fuse-current ratings and types.
    c. Relays and associated power and current transformer ratings and ratios.
    d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    e. Generator kilovolt amperes, size, voltage, and source impedance.
    f. Cables. Indicate conduit material, sizes of conductors, conductor insulation, and length.

g. Busway ampacity and impedance.
h. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Magnetic inrush current overload capabilities of transformers.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Ratings, types, and settings of utility company's overcurrent protective devices.
e. Special overcurrent protective device settings or types stipulated by utility company.
f. Time-current-characteristic curves of devices indicated to be coordinated.
g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

B. Perform coordination study and prepare a written report using the results of fault-current study and approved computer software program. Comply with IEEE 399.

C. Comply with NFPA 70 for overcurrent protection of circuit elements and devices.

D. Comply with IEEE 242 recommendations for fault currents and time intervals.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between series devices, including power utility company's upstream devices. Show the following specific information:

a. Device tag.

b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

3. Completed data sheets for setting of overcurrent protective devices.

3.5 OVERCURRENT PROTECTIVE DEVICE SETTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative, of electrical distribution equipment being set and adjusted, to assist in setting of overcurrent protective devices within equipment.

B. Perform the following device setting and prepare reports:

1. Adjust devices according to recommendations in NETA ATS.

3.6 ARC-FLASH HAZARD ANALYSIS

A. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.

B. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.

C. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.

D. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

E. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584, the IEEE “Guide for Performing Arc-Flash Calculations”.

F. Labeling on equipment shall be in compliance with the National Electrical Code and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

G. Furnish and install the arc flash labels on all equipment included in the arc flash hazard analysis.

END OF SECTION 260573

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SECTION 260943 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a networked lighting control system which includes, but is not limited to, the following components:
   1. System Software Interfaces
      a. Management and Visual Interface
      b. Historical Database and Analytics Interface
   2. System Backbone and Integration Equipment
      a. System Controller
   3. Lighting Control Devices

1.3 SUBMITTALS

A. Submittals shall include the following items:
   1. Bill of Materials for all components of the Lighting Control System
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
   3. Plan drawings showing locations of all lighting control devices and all cables connecting the devices to each other and other devices.
   4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
   5. Other Diagrams and Operational Descriptions as needed to indicate system operation or interaction with other system(s).
   6. Contractor Startup/Commissioning Worksheet which shall be completed by the contractor prior to factory start-up
   7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
   8. Hardware and Software Operation Manuals.
   9. Color selection chart for devices/equipment
   10. Screenshots of the following:
      a. Web-based visualization interface that displays a graphical floorplan (use the actual floorplan for the building in this project, generic floorplans are not acceptable). System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

B. Submittal drawings, details, and diagrams
   1. Prior to installation of lighting control devices/equipment and lighting fixture/luminaires, provide a 1/8” = 1’-0” scaled plan drawings, details, and wiring diagrams; which show locations of all devices/equipment/fixtures/luminaires, with all device addresses, wired network control zones, symbols, power/control wiring, mounting details, and other

information indicated. All equipment that require line voltage power (120V or 277V) shall be indicated on the plan drawings. At the completion of the construction, this drawing shall be updated with as-built information (including, but not limited to, exact location of all devices/equipment/fixtures/luminaires).

C. Prior to the demonstration and training, provide copies of the training materials (power point slide presentations, etc.)

D. Provide the following closeout submittals:
1. Project Record Documents: Accurately record the actual locations of Products.
2. Operating and maintenance manuals.
3. Operating Instructions: Document training by furnishing a sign-in sheet with a description on the training provided, instructors name and organization and those who received training.
4. Submit software database file with desired device labels and notes completed.
5. As-built drawings, details, and wiring diagrams

E. Provide field quality control test reports.

1.4 QUALITY ASSURANCE

A. Product Qualifications
1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled accordingly; and, shall be suitable for the intended use and location.
2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications
1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

1.5 WARRANTY

A. Provide the following warranties in addition to any warranties specified elsewhere in the contract documents:
1. The manufacturer shall provide a minimum five-year warranty on all devices and equipment. Warranty coverage shall begin on the date of shipment. The warranty shall cover repair or replacement any defective products within the warranty period.

1.6 COORDINATION

A. Coordinate the lighting control system to all other devices, equipment and systems to which it connects to. All input/output/communications interfaces/modules shall be compatible and suitable for use with each other.

B. Coordinate the names/identification/labels used by the lighting control system software/cables, with the actual room/area identification tags provided in the field.

C. Coordinate programming of the lighting control system (including, but not limited to, time delay settings, min/max light level settings, time schedules, etc.) with the owner prior to programming.

D. Coordination with the IT (Information Technology) Network Infrastructure
   1. Coordinate with the IT Network System Integrator and secure all required network connections to the IT network infrastructure.
   2. Provide all network infrastructure requirements of the lighting control system to the IT Network System Integrator.

E. Coordinate line voltage power (120V through 277V) requirements prior to starting any work to ensure that power is provided to all equipment. The contractor shall provide line voltage power to all equipment that require it, in accordance with the manufacturer's recommendations and NEC requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The Acuity Controls nLight Lighting Control System is the basis-of-design. Provide Acuity Controls nLight Lighting Control System or approved equal.

2.2 GENERAL

A. The contractor shall provide all labor, software, programming, materials, equipment, hardware, mounting, wiring, conduit, junction boxes, power supplies, transformers, batteries, equipment enclosures (all equipment shall have enclosures), and accessories as required for a complete and fully operational system. The contractor shall provide all startup and testing as required, in order to confirm that the system operates in accordance with the contract documents. The system shall comply with all applicable codes, the manufacturer's recommendations, and the requirements of the authorities having jurisdiction.

B. Where licenses are required to install, operate, and maintain the system, provide a minimum of 2 licenses, except where more licenses are required elsewhere in the contract documents, in which case, the larger quantity shall apply. Each license shall be capable of being used locally (at the building), or remotely (in remote facility through the internet).

C. Wires shall be sized and selected such that proper operation of the system is achieved. Excessive voltage drop that can adversely affect proper operation of any component in the system shall be avoided.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture
   1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) system backbone for remote, time based and global operation between control zones.

2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type.
3. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
5. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
   a. All switches control all fixtures in a zone
   b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

B. Wired Networked Control Zone Characteristics
1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
   a. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.

C. System Integration Capabilities
1. The system shall have the hardware (interface/converter/connector module/card/feature) and software that provides it with the capability of interfacing with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

D. The lighting control system shall be capable of being remotely controlled by the Lighting Control System software, either through the local area network, or remotely through the internet. Software shall be password protected.

2.4 SYSTEM SOFTWARE INTERFACES

A. General:
1. Provide Lighting Control System software that shall allow for remote control/monitoring of the lighting control system. The software shall be password protected.

B. Management Interface
1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. All system software updates must be available for automatic download and installation via the internet.

C. Historical Database and Analytics Interface

1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall upload that data to a cloud-based server.

D. Visualization Interfaces
1. System shall provide a web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

E. All lighting control devices can be programmed and controlled over the internet. Password protection shall be provided to prevent unauthorized access.

2.5 SYTEM BACKBONE AND INTEGRATION EQUIPMENT

A. System Controller
1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:
   a. Facilitation of global network communication between different areas and control zones.
   b. Time-based control of downstream wired and wireless network devices.
   c. Linking into an Ethernet network.
   d. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
5. Device shall have a standard and astronomical internal time clock.
6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.
7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS without the need for additional protocol translation gateways.
   a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
   b. BACnet/MSTP shall support 9600 to 115200 baud.
   c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
   d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).

2.6 LIGHTNG CONTROL DEVICES

A. Occupancy sensors, switches and other lighting controls shall be provided in accordance with the drawings.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Provide junction boxes as required, in accordance with the NEC and the manufacturer's recommendations.

B. Wiring Methods for Control Wiring
   1. Control wiring that is exposed, concealed inside walls/floor, or concealed above inaccessible ceilings: All control wiring shall be installed in raceway.
   2. Control wiring that is concealed above accessible ceilings: All control wiring shall be installed in raceway, unless otherwise noted and except as follows:
      a. Raceway may be omitted for control wiring if ALL of the following conditions are met:
         1) Wiring is used for Class 2 circuits
         2) Wiring is used only in dry locations;
         3) Wiring is used only in above ground applications;
         4) Wiring is not subject to physical damage;
         5) Wiring is supported and secured where such support does not exceed 3 foot intervals;
         6) Wiring is supported by hangers and supports from the building structure;
         7) Wiring is not laid on ceiling tiles
         8) Wiring shall not be fastened in a manner that puts tension on the cable;
         9) Wiring is for control wiring;
         10) Wiring shall be plenum rated (UL Type CMP);
         11) All wiring that is not enclosed by raceway shall be supported via UL Listed Metal J-Hooks (with rounded edges and integral cable retainer metal clip) and secured together with plenum rated nylon straps or clamps (the use of staples is prohibited);
         12) Wiring is concealed above accessible suspended ceilings (this includes, ceiling spaces above grid type ceilings with removable ceiling tiles); AND
         13) Raceway is omitted only where it is allowed to be omitted by the National Electrical Code, NFPA Codes, applicable codes, and the contract documents.

C. Provide CAT6 data cable from the lighting control system to the network switches, to allow the lighting control system to be monitored and controlled through the local area network by a computer with the lighting control software (software provided by the contractor). Coordinate exact location of the network switches in the field. All work shall comply with the manufacturer's recommendations, the NEC, and the contract documents.

D. All junction box covers shall be painted CYAN.

E. Provide the following label on the network switch port used to communicate with the Access Control System: "LIGHTING CONTROL SYSTEM".

F. Adjust exact location of photocells, photocontrols, and photosensors in the field so that the best possible view of the sunlight is provided, and the manufacturer's installation recommendations are followed.

G. Adjust exact location of occupancy sensors so that any motion within the room or space is detected by the occupancy sensors, and the manufacturer's installation recommendations are followed.

H. All switches and pushbuttons shall be labeled as to which lights are being controlled. Unused switches and pushbuttons shall be labeled as “spare”.

I. Adjust exact location of sensors so that their sensor coverage is not blocked by raceways, boxes, and other equipment.

J. Coordinate electrical power supply connection type with the equipment. Where the equipment requires a receptacle connection, provide a receptacle. Where the equipment requires a hardwired connection, provide a hardwired connection. Coordinate all work with the manufacturer and the installation manuals. All work shall comply with the NEC, the manufacturer’s recommendations, and the contract documents.

3.2 INSTALLATION

A. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

B. Cables shall have a minimum separation of 12 inches from 120V or higher power wiring. Cables shall have a minimum separation of 12 inches from light fixtures.

C. All wall and floor penetrations shall be sleeved. All conduit and sleeve ends must have bushings to prevent chafing. Where a conduit or other through-penetration device is installed through a fire rated assembly, the opening around the sleeve and the hole through the sleeve shall be sealed with an Underwriters Laboratory approved fire rated sealant material after the cables have been installed.

D. Install cables without damaging conductors or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
4. Monitor cable pulling tensions.

G. Install cables parallel and perpendicular to surfaces or structural members and follow surface contours where possible.

H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper telephone and data communication cabling from potential EMI sources, including electrical power lines and equipment.

J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect panels.

K. Use splice and tap connectors compatible with media types.

L. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

M. In the communications equipment room, install a 5-foot- long service loop on each end of cable.

N. Cable support inside wiring closets, telecommunications closets, data closets:

1. Support horizontal and backbone cabling from the fire retardant plywood board in each closet.
2. Provide cable ties and cable tie mounts to support the horizontal and backbone cabling from the plywood board. Provide cable ties every 3”.
3. Cable tie mount shall be manufactured by Panduit or approved equal and shall use galvanized steel screws as the mounting method. Cable tie mount shall be UL Recognized. Cable tie mount size shall be suitable for the cables being supported.

O. Install all devices and equipment in accordance with the manufacturer’s requirements.

3.3 IDENTIFICATION

A. Identify system devices, equipment, components, wiring, cabling, and terminals. Comply with the requirements for identification specified in Specification Section "Electrical Identification". Comply with the identification requirements of the applicable codes.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
1. Walkthrough each room/area and confirm that each lighting control device (switch, occupancy sensor, etc.) can turn on the lights within the room/area.
2. Confirm that each dimming control device can dim the lights from its minimum to maximum dimming level.
3. Confirm that each photosensor used for dimming or on/off switching is capable of dimming the associated lights, and/or turning the associated lights on/off.
4. Confirm that each time schedule used to turn the lights on/off controls the lights at the appropriate day/time.
5. Test all the low voltage, data, and/or communications cables, using a cable to tester, and confirm with the lighting control system manufacturer that the cables meet all the criteria that are needed for a complete and fully operational lighting control system.

C. Prepare test and inspection reports.

D. Remove and replace items which failed the tests/inspections, and then re-test/re-inspect.

E. Prepare re-test and re-inspection reports.

3.5 SYSTEM STARTUP

A. Installation Procedures and Verification
   1. The contractor shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
   2. The contractor shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
   3. The contractor shall be responsible for testing of all low voltage network cable included in the bid. The contractor is responsible for verification of the following minimum parameters:
      a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
      b. Length
      c. Insertion Loss

B. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
   1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.

C. System start-up and programming shall include:
   1. Verifying operational communication to all system devices.
   2. Programming the network devices into functional control zones to meet the required sequence of operation.
   3. Programming and verifying all sequence of operations.
   4. Customization of owner's software interfaces and applications.

D. Initial start-up and programming shall occur on-site. Additional programming shall also occur on-site, unless otherwise noted and except as follows:
   1. Additional programming may be done over the Internet, where all of the following conditions are met:
      a. The additional programming does not require physical access to the equipment and can be made through the internet.
      b. The contractor provides all the hardware, software, and other equipment as required to be enable to access the internet.

3.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for five (5) years. Technical support shall include the following:
   1. Toll free technical support via phone
   2. Technical support via the internet

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five (5) years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the lighting control system.

B. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation and maintenance of the installed System.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

END OF SECTION 260943

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. MCB: Main Circuit Breaker

C. KAIC: Thousand Ampere Interrupting Capacity

D. Branch Breaker: A circuit breaker at a panelboard, that is located on the loadside of the Main Circuit Breaker or Main Lugs of that panelboard.

E. NEC: National Electrical Code

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. Provide size/quantity for all wire lugs/terminals at the equipment.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Service Conditions: NEMA PB 1, usual service conditions.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate wire terminals/lugs at the equipment with the wires that are connected to it. Wire terminals/lugs shall be suitable for use with the wires that are connected to.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- or surface-mounted cabinets, as indicated on the drawings.

1. Rated for environmental conditions at installed location. See drawings for NEMA 250 enclosure type.
2. Finishes: Steel (unless otherwise noted), factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
3. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Phase and Neutral, Buses:

1. Material: Copper, unless otherwise noted

C. Ground Buses:
1. Equipment Ground Bus: Copper. Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus-Configured Terminators: Mechanical type.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Multi-Section Panelboards:

1. Multi-Section Panelboards shall have equal-height boxes and common trim.

G. Panelboard Short-Circuit Current Rating:
1. Fully rated to interrupt symmetrical short-circuit current available at terminals, unless otherwise noted.

H. Where the Panel Schedules (the Panel Schedules are shown on the drawings) indicate that a 200% neutral is required; this shall mean that the panel shall have a neural bs that is rated at 200% of the phase bus, and is UL listed as suitable for non-linear loads. Neutral wire terminals/connectors shall be suitable for use with the wiring indicated in the drawings.

I. All service equipment shall have barriers in place, such that no uninsulated ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

2.2 DISTRIBUTION PANELBOARD

A. Manufacturers: Square D is the basis-of-design manufacturer. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work also include, but are not limited to, the following:
1. General Electric Company.
2. Siemens Energy & Automation, Inc.

3. Eaton

B. Panelboards: Comply with NEMA PB 1

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike. All panelboards shall have doors, and all doors shall have locks (provide a minimum of 3 keys per lock). All panelboards shall be keyed alike.
   1. For doors more than 36 inches high, provide two latches, keyed alike.

D. All panelboards with service disconnects shall be UL listed as suitable for use as service equipment.

E. Dimensions of Panelboards shall not exceed the following:
   1. Box Width: 44”
   2. Box Depth: 9.5”
   3. Enclosure Height: Varies based on the quantity of circuit breakers and spaces.

F. Basis-of-Design Distribution Panelboards:
   1. Square-D Type I-LINE

2.3 BRANCH CIRCUIT PANELBOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: Comply with NEMA PB 1

C. All panelboards with service disconnects shall be UL listed as suitable for use as service equipment.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Provide single door construction, made of cold-rolled steel. Door shall have concealed hinges, flush catch, and lock. Secure top and bottom of door to cabinet by slotted steel bolts. Release shall be by one-half turn with a screwdriver. All panelboards shall have doors, and all doors shall have locks (provide a minimum of 3 keys per lock). All panelboards shall be keyed alike.
   1. Panelboards shall be equipped with “door within door” type trim. The entire front trim shall be hinged to the box, and a standard door shall be within the hinged trim cover.

F. Dimensions of 120/208V Panelboards shall not exceed the following:
   1. Box Width: 20”
   2. Box Depth: 5.75”
   3. Enclosure Height: Varies based on the quantity of circuit breakers and spaces.

G. Basis of Design Branch Circuit Panelboards:
   1. 120/208V Panels: Square-D Type NQ

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (5-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment;
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
g. Handle Clamp: The handle clamp shall prevent the circuit breaker handle from being manually switched to the OFF position. Handle clamp shall not prevent the circuit breaker from tripping. Authorized personnel shall have the capability to remove the handle clamp.
h. Trip-free mechanism: allows breaker to trip even with the handle locked or held in the ON position.
i. Circuit breakers shall be suitable for reverse feed.

C. Where the Panel Schedules (the Panel Schedules are shown on the drawings) indicate that the main circuit breaker or any circuit breaker shall have adjustable LSI trip settings, this shall mean that the circuit breaker shall have an electronic trip unit, and that the following trip settings shall be field adjustable:
1. Long Time Pickup
2. Short Time Pickup
3. Instantaneous Pickup
4. Long Time Delay
5. Short Time Delay

D. Where the Panel Schedules (the Panel Schedules are shown on the drawings) indicate that the main circuit breaker or any circuit breaker shall have adjustable LSIG trip settings, this shall mean that the circuit breaker shall have an electronic trip unit, and that the following trip settings shall be field adjustable:
1. Long Time Pickup
2. Short Time Pickup
3. Instantaneous Pickup

4. Ground Fault Pickup
5. Long Time Delay
6. Short Time Delay
7. Ground Fault Time Delay

E. Where the Panel Schedules (the Panel Schedules are shown on the drawings) indicate that the main circuit breaker or any circuit breaker shall be 100% rated, this shall mean that the circuit breaker is UL listed as suitable for carrying 100% of rated current continuously.

F. Circuit breakers which incorporate ground fault protection shall have the following features:
1. Ground fault push-to-trip button
2. Ground fault trip indicator light

G. For circuit breakers rated 800A and less, comply with the following:
1. Where the circuit breaker has an electronic trip unit with an adjustable long time trip setting, the sensor plug, which sets the maximum trip the circuit breaker can be adjusted to, shall not be greater than 800A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount panelboard at one of the following mounting heights, unless otherwise indicated on the drawings:
1. Wherever the overall height of the panelboard is 5’ or less, mount the panelboard such that the top of the panelboard enclosure is located at 6’ above the finished floor.
2. Wherever the overall height of the panelboard is greater than 5’, mount the panelboard such that the center of the grip of the operating handle of the top-most circuit breaker, when in the highest position, is not more than 6’-6” above the finished floor. Where the topmost circuit breaker position is a space for a future circuit breaker, assume that there is a circuit breaker mounted in the space for determining the mounting height of the panelboard.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

G. Comply with NECA 1.

H. Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column, or other parts of building structure.

I. Spare circuit breakers and spaces for future circuit breakers shall be located towards the top of the panelboards.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Specification Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Specification Section "Electrical Identification."

D. Service Equipment Label: Service equipment shall be NRTL labeled for use as service equipment.

3.4 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Engage a qualified testing agency and perform the following tests and inspections, and prepare test reports:

    a. Perform each visual and mechanical inspection and electrical test stated in the NETA Acceptance Testing Specification. Certify compliance with test parameters.

        1) Electrical tests are required for all panelboards. Visual and mechanical inspections are required on all panelboards.

2. The testing agency shall coordinate with the manufacturer of the item being tested, and shall obtain copies of the installation/testing manuals. The testing agency shall not exceed the test voltage/current/duration limits indicated by the manufacturer.

3. Remove and replace items which do not pass the tests. Test the replacement items.

3.6 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to maintain panelboards. Provide a minimum of 4 hours of training.

END OF SECTION 262416

SECTION 262713 – ELECTRIC UTILITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes equipment for utility company's electricity metering.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:

1. Electricity-metering equipment.

B. Shop Drawings for Electricity-Metering Equipment:

1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For electricity-metering equipment to include in emergency, operation, and maintenance manuals.

E. Submit product data and shop drawings to the electric utility for review and approval.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter stack as specified in NECA 400.

1.6 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power and communication services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Current-Transformer Cabinets for Utility Company Metering: Comply with requirements of electrical power utility company.

B. Meter Sockets for Utility Company Metering: Comply with requirements of electrical power utility company.

2.3 IDENTIFICATION

A. Service Equipment Label: Service equipment shall be UL labeled for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Furnish and install equipment for utility company metering. Furnish and install associated raceways, troughs, wireways, enclosures, cabinets, and other equipment according to the utility company's requirements.

END OF SECTION 262713

SECTION 262714 - ELECTRIC SUBMETERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Submittals shall include the following items:
   1. Bill of Materials for all components of the electric submetering system
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
   3. Plan drawings showing locations of all electric submetering equipment and all cables connecting the equipment to each other and other equipment
   4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
   5. Other Diagrams and Operational Descriptions as needed to indicate system operation or interaction with other system(s).
   6. Contractor Startup Worksheet which shall be completed by the contractor prior to factory start-up
   7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
   8. Hardware and Software Operation Manuals.
   9. Screenshots of the following:
      a. Displays on the laptop with the energy software, to indicate how the submetering data will be shown.

B. Submittal drawings, details, and diagrams
   1. Prior to installation of electric submetering equipment, provide a 1/8” = 1’-0” scaled plan drawings, details, and wiring diagrams; which show locations of all equipment, with all equipment addresses, symbols, power/control wiring, mounting details, and other information indicated. All equipment that require line voltage power shall be indicated on the plan drawings. At the completion of the construction, this drawing shall be updated with as-built information.

C. Prior to the demonstration and training, provide copies of the training materials (power point slide presentations, etc.)

D. Provide the following closeout submittals:
   1. Project Record Documents: Accurately record the actual locations of Products.
   2. Operating and Maintenance manuals. In addition to items specified elsewhere in the contract documents, include the following:
      a. Application and operating software documentation.
      b. Software licenses: The license to use the software shall not expire.
      c. Software service agreement.
      d. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF file copies of the hard-copy Submittal on USB drives.

3. Operating Instructions: Document training by furnishing a sign-in sheet with a description on the training provided, instructors name and organization and those who received training.
4. Submit software database file with desired device labels and notes completed.
5. As-built drawings, details, and wiring diagrams

E. Provide field quality control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Comply with NECA 1.

1.4 COORDINATION

A. Coordinate the equipment indicated in this specification section with all other equipment and systems it connects to. All input/output/communications interfaces/modules shall be compatible and suitable for use with each other.

B. Coordinate programming of system with the preferences of the owner. Comply with the owner's requirements, except where it conflicts with the applicable codes or the requirements of the authorities having jurisdiction.

C. Where equipment are connected to the data network system, coordinate all network settings/configurations with the owner's IT (Information Technology) department.

D. Coordinate line voltage power requirements prior to starting any work to ensure that power is provided to all equipment. The contractor shall provide line voltage power to all equipment that require it, in accordance with the manufacturer's recommendations and NEC requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Where the contract documents specifies a product name, model, or manufacturer, this product shall be considered as the basis-of-design product. The contractor shall provide the basis-of-design product or approved equal. All products shall be submitted for review and approval by the design team.

2.2 GENERAL

A. The contractor shall provide all labor, software, programming, materials, equipment, hardware, mounting, wiring, conduit, junction boxes, power supplies, transformers, batteries, equipment enclosures (all equipment shall have enclosures), and accessories as required for a complete and fully operational system. The contractor shall provide all startup and testing as required, in

order to confirm that the system operates in accordance with the contract documents. The system shall comply with all applicable codes, the manufacturer's recommendations, and the requirements of the authorities having jurisdiction.

B. Where licenses are required to install, operate, and maintain the system, provide a minimum of 2 licenses, except where more licenses are required elsewhere in the contract documents, in which case, the larger quantity shall apply. Each license shall be capable of being used locally (at the building), or remotely (in remote facility through the internet).

C. Wires shall be sized and selected such that proper operation of the system is achieved. Excessive voltage drop that can adversely affect proper operation of any component in the system shall be avoided.

D. Provide the following spare parts:
   1. Provide a 10% spare fuses for each type of fuse. Fuse shall be provided in a box that is labeled to indicate which types of equipment will use the fuse.

2.3 ELECTRIC SUBMETER

A. Provide Honeywell E-Mon Class 5000 Green Net Smart Meter with the following features:
   1. Advanced 4-line display showing
      a. kWh delivered, received and Net kWh
      b. kW demand (with peak date and time)
      c. Power factor per phase
      d. Amps per phase
      e. Volts per phase
      f. On-board set-up option for:
         1) IP address
         2) Meter date/time
         3) ID codes for EZ7, Modbus and BACnet
   2. 0-2 volt output current sensors allow for enhanced safety and accurate remote mounting of sensors up to 500 feet from meter without power interruption.
   3. Onboard installation diagnostics and verification system
   4. Phase loss alarm (normally open contact)
   5. Built-in RS-485 communication capability supports the following connection configurations (or combinations not to exceed 52 devices per channel):
      a. Each channel can accommodate up to 4,000 feet of cabling, with up to 52 submeters daisy chained together.
   6. Records kWh and kVARh delivered, kWh and kVARh received in first four channels. Data stored in 15 minute intervals for up to 72 days or 5 minute intervals for up to 24 days. Data is maintained in a first-in, first-out format.
   7. Suitable for 3 phase, 3 wire; 3 phase, 4 wire; or, 1 phase, 3 wire, applications. Provide additional equipment that are needed to make the meter compatible with the voltage configuration of the associated circuit/equipment.
   8. Outdoor NEMA 4X polycarbonate enclosure with padlocking hasp and mounting flanges for indoor/outdoor installation.
   9. UL Listed. Meets or exceeds ANSI C12.20 national accuracy standards (+/-0.2% from 1% to 100% of rated load)
   10. Meets or exceed MID (Measuring Instruments Directive) accuracy standards
   11. Meter shall be field programable for meter date/time, IP address and ID code for communication purposes.
   12. The communications protocol of the electric submeter shall be coordinated with all other systems/equipment connected the electric submetering system
   13. Voltage rating/configuration of the electric submeter shall be compatible with the voltage rating/configuration of the circuit/equipment being submetered.

14. The electric submeter shall be capable of accurately measuring all currents from zero amperes, up to the continuous current ampere rating of the associated current sensor.
15. Dimensions of the electric submeter shall not exceed 6” high x 6” wide x 4.25” deep.

B. The submeter data shall be accessible over the local and wide area networks.

2.4 ENERGY SOFTWARE

A. Energy software shall be Honeywell E-Mon Energy Software with the following features:
1. Software is an energy-monitoring system that allows users to read and monitor energy consumption easily and effectively via on-site or off-site non-dedicated computers. The software allows the user to generate graphs and profiles of energy data for demand analysis and usage reduction. The software shall also generate electrical bills for usage verification.
2. Graphic profiling provides analytical charts and graphs with demand profiling for 5, 15, 30 or 60 minute sampling rates.
3. Generate and print itemized electric bills (using coincidental peak demand date and time). Software shall generate bills from user-specific time periods via profile data (you need not be present to generate meter readings).
4. Reads up to 8 time periods, 4 seasons and multiple holidays for time-of-use (TOU) monitoring.
5. Reads the electric submeters, either on-site or off-site, via ethernet
6. Exports data to spreadsheets for analysis (*.csv files)
7. Exports data to MV-90 system (*.hhf files)

B. The contractor shall provide a dedicated laptop that is capable of using the Energy Software, and accessing the submeter data over the local and wide area networks. The Energy Software shall be installed on the laptop. The laptop shall become the property of the owner.

PART 3 - EXECUTION

3.1 APPLICATION

A. Program the energy software with the actual billing rates of the electric utility for the facility, such that the owner can see the amount (in dollars) he is using in electricity.

3.2 INSTALLATION

A. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

B. Cables shall have a minimum separation of 12 inches from 120V or higher power wiring. Cables shall have a minimum separation of 12 inches from light fixtures.

C. All wall and floor penetrations shall be sleeved. All conduit and sleeve ends must have bushings to prevent chafing. Where a conduit or other through-penetration device is installed through a fire rated assembly, the opening around the sleeve and the hole through the sleeve shall be sealed with an Underwriters Laboratory approved fire rated sealant material after the cables have been installed.

D. Install cables without damaging conductors or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
4. Monitor cable pulling tensions.

G. Install cables parallel and perpendicular to surfaces or structural members and follow surface contours where possible.

H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper telephone and data communication cabling from potential EMI sources, including electrical power lines and equipment.

J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect panels.

K. Use splice and tap connectors compatible with media types.

L. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

M. In the communications equipment room, install a 5-foot- long service loop on each end of cable.

N. Cable support inside wiring closets, telecommunications closets, data closets:
1. Support horizontal and backbone cabling from the fire retardant plywood board in each closet.
2. Provide cable ties and cable tie mounts to support the horizontal and backbone cabling from the plywood board. Provide cable ties every 3”.
3. Cable tie mount shall be manufactured by Panduit or approved equal and shall use galvanized steel screws as the mounting method. Cable tie mount shall be UL Recognized. Cable tie mount size shall be suitable for the cables being supported.

O. Install all devices and equipment in accordance with the manufacturer’s requirements.

P. Prior to installing devices and equipment, the contractor shall coordinate the exact locations where the devices and equipment are being installed with the plan drawings and existing conditions, and shall notify the engineer immediately if there are any issues or conflicts. The coordinated locations shall be indicated in the shop drawing submittals. Where conflicts are found during or after the shop drawing submittal process, but before installation of the devices and equipment, the contractor shall notify the engineer of the conflict, and shall adjust the locations of the devices and equipment, where directed by the engineer to do so. The contractor’s bid price shall include adjusting the locations of devices and equipment up to 12 feet from the locations on the plan drawings, unless otherwise noted.

Q. All programmable and adjustable settings and sequence of operations shall be coordinated with the owner, and set in accordance with the owner's recommendations. Where the owner has no preference, provide a recommendation for the owner's review. Provide eight (8) hours of on-site meetings with the owner, to discuss and make decisions related to the programmable/adjustable settings/sequence of operations. Prior to meeting with the owner on-site, submit a list of items to be discussed, so that the owner is prepared for the on-site discussions.

R. All equipment shall be installed plumb and level.

S. Clean all equipment in accordance with the manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pretesting, testing, and adjusting of video surveillance equipment.

B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

C. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare electric submetering equipment for acceptance and operational testing as follows:
   1. Connect a resistive load on all phases of the load side of each electric submeter, and confirm that the correct ampere reading is displayed on the submeter display, and the laptop with the energy software.

D. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

E. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

F. Remove and replace malfunctioning items and retest as specified above.

G. Record test results for each piece of equipment.

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.4 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 16 Section "Electrical Identification".

B. Each equipment shall be labeled with an address/identification name/number which matches information provided in the submittals or indicated in the drawings. Identify each cable segment between equipment with a unique number corresponding to the address/identification

name/number of the associated equipment. Provide a cable schedule which identifies each cable segment and the associated equipment.

3.5 SOFTWARE SERVICE AGREEMENT

A. Provide software technical support as follows:
   1. Beginning at Substantial Completion, service agreement shall include software support for two (2) years.
   2. Technical support shall include the following:
      a. Toll free technical support via phone
      b. Technical support via the internet

B. Provide software upgrade service as follows:
   1. At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   2. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.6 DEMONSTRATION AND TRAINING

A. The contractor shall provide to the owner, complete manuals of the completed system. The manuals shall include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams, and a manufacturer's suggested spare parts list.

B. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of eight (8) hours to instruct the owners' designated personnel on the operation and maintenance of the entire system.

C. During the training, the instructor shall provide a laptop that is loaded with the system software, which allows the trainees to monitor and control the system through the network. At the end of the training, this laptop and all software installed on it, shall become the property of the owner, at no additional cost.

D. Training shall be on-site, and hands-on, using the actual equipment installed at the project site.

E. Provide training on how to operate and maintain the system. Also, provide the following additional training:
   1. How to view and analyze the submetering data

END OF SECTION 262714

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches.
3. Device wall plates.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. Heavy Duty Grade: Industrial Grade

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Mfg. Company Inc.
   c. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. GFCI Receptacles: Straight blade, feed-through type; heavy-duty grade, with ground fault protection, test and reset pushbuttons; NEMA WD 6, duplex receptacle; Complies with UL 498 and UL 943. Design units for installation in a 2-3/4 inch deep outlet box without an adapter.

D. All 15 and 20 ampere receptacles in wet locations shall be UL listed as weather-resistant.

2.3 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Stainless steel screws.
2. Material for Switches and Receptacles in Dry Locations: 0.035-inch-thick, satin-finished stainless steel, unless otherwise noted

3. Material for Receptacles in Wet Locations and Outdoors, or where the drawings indicate that the receptacle cover shall be weatherproof:
   a. Cast aluminum construction.
   b. Mounting screws and gaskets included for fast, easy installation onto surface mounted outdoor type boxes or flush-mounted wall boxes.
   c. Weatherproof while-in-unattended use with cover closed and plug inserted.
   d. Cover shall have provisions for padlocks.
   e. Depth of cover shall not exceed 3.5".
4. Material for Switches in Wet Locations and Outdoors, or where the drawings indicate that the switch cover shall be weatherproof:
   a. Cast aluminum construction
   b. Mounting screws and gaskets included for fast, easy installation onto surface-mounted outdoor type boxes or flush-mounted wall boxes.
   c. Cover shall have provisions for padlocks.
   d. Suitable for use in wet locations.
   e. Switch cover shall be O-Z/Gedney FS-1-WSCA for single gang boxes and FS-2-WSCA for two gang boxes, or approved equal.

2.6 FINISHES

A. Color:
   1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

C. Coordination with Other Trades:

   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Remove wall plates and protect devices and assemblies during painting.

D. Conductors:

   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

E. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
5. Tighten unused terminal screws on the device.
6. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 CONNECTIONS

A. Ground equipment according to Specification Section "Grounding and Bonding."

B. Connect wiring according to Specification Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches, controllers and motor-control centers.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

a. Let-through current curves for fuses with current-limiting characteristics.
b. Time-current curves, coordination charts and tables, and related data.
c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Feeders: Class RK1, time delay, except as follows:
1. Class J Fuses shall be used where indicated on the drawings. Class J fuses shall be time delay type unless otherwise noted.
2. Class L Fuses shall be used where indicated on the drawings. Class L fuses shall be time delay type unless otherwise noted.

B. Motor Branch Circuits: Class RK1, time delay.

C. Other Branch Circuits: Class RK1, time delay, except as follows:
1. Class J Fuses shall be used where indicated on the drawings. Class J fuses shall be time delay type unless otherwise noted.
2. Class L Fuses shall be used where indicated on the drawings. Class L fuses shall be time delay type unless otherwise noted.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosed molded-case circuit breakers.
4. Enclosures.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
5. Provide size/quantity for all wire lugs/terminals at the equipment.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate wire terminals/lugs at the equipment with the wires that are connected to it. Wire terminals/lugs shall be suitable for use with the wires that are connected to.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:
   a. Fuses for Fusible Switches:
      1) Provide 3 spare fuses for each fused switch rated 100A and higher.
      2) Provide 10% spare fuses for fuses rated less than 100A.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Type HD, Heavy Duty Switch: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Provisions for padlocks: Fusible and non-fusible switches shall include provisions for being padlocked in the open or closed position.

D. Fusible switches shall be suitable for use with Class R fuses unless otherwise noted and except as follows:
1. Provide fusible switches with Class J fuses where indicated on the drawings.
2. Provide fusible switches with Class L fuses where indicated on the drawings.

E. Fusible switches shall have clips or bolt pads to accommodate specified fuses.

F. Short circuit rating of Type HD Fusible Switches when used with Class R, Class J, or Class L fuses shall not be less than 200,000A.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

H. Voltage Rating:
1. Fusible switches: Switches shall be rated for 240V or 600V as indicated on the drawings.
2. Non-fusible switches: Switches shall be rated for 600V.
    a. Where 208V is indicated in the drawings, this is intended to show that the supplied voltage for the circuit is 208V. However, switch shall still be rated for 600V.
    b. Where 240V is indicated in the drawings, this is intended to show that the supplied voltage for the circuit is either 208V or 240V. However, switch shall still be rated for 600V.

I. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

J. All service equipment shall have barriers in place, such that no uninsulated ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

2.3 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

C. Provisions for padlocks: Molded-Case Circuit-Breakers shall include provisions for being padlocked in the open or closed position.

1. When the breaker is padlocked in the closed position, the padlock shall not prevent the breaker from tripping due to overcurrent conditions.
2. Enclosed circuit breakers with NEMA 1 Enclosures that are required to be lockable shall have Handle Padlock Attachments.

D. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment;
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
6. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

E. Circuit Breaker Short-Circuit Current Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals.

F. Circuit breakers which incorporate ground fault protection shall have the following features:
1. Ground fault push-to-trip button
2. Ground fault trip indicator light

G. Enclosed circuit breaker dimensions shall not exceed the following:
1. Enclosed Circuit Breakers rated 600A and higher: 53” high x 21” wide x 10” deep
2. Enclosed Circuit Breakers rated 100A and less:19” high x 9” wide x 5” deep

H. For circuit breakers rated 800A and less, comply with the following:
1. Where the circuit breaker has an electronic trip unit with an adjustable long time trip setting, the sensor plug, which sets the maximum trip the circuit breaker can be adjusted to, shall not be greater than 800A.

I. All service equipment shall have barriers in place, such that no uninsulated ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location. See drawings for NEMA 250 enclosure type.

2.5 IDENTIFICATION

A. Service Equipment Label: Service equipment shall be UL labeled for use as service equipment.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. All disconnects for elevators shall have an auxiliary contact to indicate switch position.

B. All Fusible and Nonfusible Switches shall be Type HD, Heavy Duty Switches.

3.2 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Provide UL Listed fuse reducers as required

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Specification Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure as specified in Specification Section "Electrical Identification."

3.5 ADJUSTING

A. Set field-adjustable circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Engage a qualified testing agency and perform the following tests and inspections, and prepare test reports:
a. Perform each visual and mechanical inspection and electrical test stated in the NETA Acceptance Testing Specification. Certify compliance with test parameters.
1) Electrical tests are required for switches and enclosed circuit breakers that are rated 100A and higher. Visual and mechanical inspections are required on all switches and enclosed circuit breakers.
2. The testing agency shall coordinate with the manufacturer of the item being tested, and shall obtain copies of the installation/testing manuals. The testing agency shall not exceed the test voltage/current/duration limits indicated by the manufacturer.
3. Remove and replace items which do not pass the tests. Test the replacement items.

END OF SECTION 262816

SECTION 263213 - PACKAGED ENGINE GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.

B. Related Sections include the following:

1. Specification Section "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

C. The generator system shall be capable of being remotely monitored and controlled by the Generator Monitoring and Control Software, either through the local area network, or remotely through the internet. Software shall be password protected.

D. The contractor shall provide all labor, programming, materials, equipment, hardware, mounting, wiring, conduit, junction boxes, power supplies, and accessories as required for a complete and fully operational generator and transfer switch power system. The contractor shall provide all startup and testing as required, in order to confirm that the generators and transfer switches operate in accordance with the contract documents. The generators and transfer switches shall comply with all applicable codes, the manufacturer’s recommendations, and the requirements of the authorities having jurisdiction.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

3. Locked Rotor Motor Starting Curve for generator
4. Three Phase Efficiency Curve for generator
5. Short Circuit Decrement Curve for generator
6. Maximum available short circuit current produced by the generator
7. Provide size/quantity for all wire lugs/terminals at the equipment.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For installer and manufacturer

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Factory Test Reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

H. Warranty: Special warranty specified in this Section.

I. Screenshots of the following:
1. The Generator Monitoring and Control Software.

J. Provide a copy of any applications made to the Maryland Public Service Commission and/or the Maryland Department of the Environment. Provide evidence that the applications have been submitted and approved prior to purchase and installation of the generator.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than 4 hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 30.

H. Comply with NFPA 70.

I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

J. Comply with UL 2200.

K. Engine Exhaust Emissions: Comply with applicable federal, state and local government requirements, whichever is the most stringent.

L. Generator engine shall be EPA (Environmental Protection Agency) certified to the latest EPA requirements.

M. The generator shall pass all the requirements of the Maryland Department of the Environment.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet.

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases.

B. Coordinate wire terminals/lugs at the equipment with the wires that are connected to it. Wire terminals/lugs shall be suitable for use with the wires that are connected to.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Lubricating oil: Provide enough for one complete oil change.
5. Coolant: Provide equivalent to the capacity of the radiator.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide a generator set manufactured by Kohler Power Systems, or a comparable product by one of the following:
1. Onan/Cummins Power Generation; Industrial Business Group.
2. Katolight.
3. Caterpillar; Engine Div.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated on the drawings.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Provide a battery heater. The Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Fuel Capacity: As indicated in the drawings.
3. Vandal-resistant fill cap.
4. Low-Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. Provide normal and emergency vents with vent caps.
6. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.

a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of fuel tank leak.

C. Height of fuel tank shall be 30 inches or less.

D. Tank Markings
1. Provide tank number and safe fuel fill height
2. Provide NFPA 704 identification

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.
13. Contacts for remote indication of Generator Running and Generator Fault on the Fire Alarm System
14. Ground Fault Indication and Protection in accordance with NEC Requirements.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

E. Remote Alarm Annunciator: Comply with NFPA 110 Level 1. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated. In addition to the alarms required by NFPA 110 Level 1, provide the following:

1. Indication of fuel rupture basin switch activation.
2. Ground Fault Indication.
3. Alarm condition at the UPS (Uninterruptible Power Supply)
4. Alarm condition at the ATS (Automatic Transfer Switch)
5. Indicate when the ATS is connected to the generator

F. Remote Emergency-Stop Switch: Surface; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

G. The controller shall have an ethernet connection to allow for connection to the IT (Information Technology) network.

2.6 GENERAOTR MONITORING AND CONTROL SOFTWARE

A. GENERAL
1. Provide Generator Monitoring and Control software which shall allow for remote control/monitoring of the generator system. The software shall be password protected.

B. The software shall have the following features:
1. Monitor and control the generator and transfer switches through a Windows based graphical user interface.
2. View the status of all devices on one site overview screen
3. Password-protected data access: Guest, User, and Supervisor
4. Monitor and control systems over the local area network, or remotely through the internet.
5. Start or stop the generator set from a PC
6. Read and adjust trip points, time delays, and system parameter settings

7. Assign inputs and outputs
8. View system run time history
9. View up to 100 recent events including engine starts, faults, shutdowns, and warnings.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; complying with UL 489.
   1. Trip Settings: Selected to coordinate with generator thermal damage curve.
   2. Mounting: Adjacent to or integrated with control and monitoring panel.
   3. Where there are multiple circuit breakers at the generator, provide separate enclosures for each circuit breaker to isolate the circuit breakers from each other, in order to comply with NEC requirements for separation of emergency systems. Where one of the circuit breaker is shipped loose, the contractor shall field install the circuit breaker in accordance with the manufacturer's recommendations and NEC requirements.
   4. Circuit breakers which incorporate ground fault protection shall have the following features:
      a. Ground fault push-to-trip button
      b. Ground fault trip indicator light
   5. For circuit breakers rated 800A and less, comply with the following:
      a. Where the circuit breaker has an electronic trip unit with an adjustable long time trip setting, the sensor plug, which sets the maximum trip the circuit breaker can be adjusted to, shall not be greater than 800A.
   6. See drawings for additional circuit breaker requirements.

B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

   1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
   2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
   3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
   4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
   5. Provide the following protections:
      a. Alternator Protection
         1) AC sensing loss
         2) Critical overvoltage
         3) Generator running
         4) Locked rotor
      b. AC Protection (the following will shutdown the generator)
         1) Alternator protection (short circuit and overload)
         2) Overcurrent (through a combination of current transformers and overcurrent relay).
         3) Overfrequency
         4) Overpower
         5) Overvoltage
         6) Reverse power

7) Underfrequency
8) Undervoltage

C. Lockable: Generator Circuit Breakers shall be provided with provisions for padlock attachments. Provide padlock and 3 keys to the owner for each breaker. Trip-free mechanism shall allow the breaker to trip even when the handle is locked or held in the ON position.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Exciter Type: Permanent Magnet Generator (PMG)

C. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

D. Electrical Insulation: Class H.

E. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. The maximum available short circuit current produced by the generator shall not exceed the short circuit current rating of the generator circuit breaker.

L. The ampacity of the conductors from the generator terminals to the first distribution device(s) containing overcurrent protection shall comply with NEC and UL Requirements.

M. Provide thermostatically controlled generator strip heater.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound attenuated, vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.

2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
4. Hinged Doors: With padlocking provisions.
5. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
6. Muffler/Silencer Location: Internal to enclosure.

B. The sound-attenuated enclosure shall provide an average of not more than 75 dbA (at full rated load of the generator-set) sound level at 23 feet. Acoustic insulation shall be provided that meets UL94 HF1 flammability classification.

C. Air intakes shall be located at the generator end of the packaged engine generator. The air intake openings shall be located on the sides of the enclosure, at the generator end. The air discharge/muffler/silencer shall be located on the opposite end of the enclosure. The air discharge opening shall be on the top of the enclosure, and the muffler/silencer shall discharge exhaust air vertically upwards.

D. Air discharge openings on the sides of the enclosure are not acceptable. Muffler/silencer which discharge exhaust air horizontally are not acceptable.

E. Overall generator dimensions (with base mounted fuel oil tank) shall not exceed 16.5’ long x 5.5’ wide x 10’ high.

F. Overall generator weight (with maximum fuel) shall not exceed 21,000 lbs.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

B. Non-spring type vibration isolators, such as rubber pads, are unacceptable.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

D. The contractor shall apply for, submit, and secure any required permits from the Maryland Public Service Commission and the Maryland Department of the Environment. The contractor shall pay for all required fees. The contractor shall fill-in and complete all forms that are required. Applications that need to be applied for, submitted, and secured; include but are not limited to, the following:
   1. Air Quality Permit to Construct & Registration Application for Emergency Generator, for the Maryland Department of the Environment. At a minimum, the following information are required in the application: facility information/address, owner information, installer information, specific generator information, vendor literature, and worker’s compensation information.

E. Clearances around the generator shall comply with he manufacturer’s recommendations and the applicable codes.

F. Provide network wiring in 1” minimum conduit (where the conduit runs underground, see the drawings for the conduit size), from the generator controller to the IT network to allow the generator to be controlled through the local area network, or remotely over the internet. Coordinate the exact location of the generator controller and IT network equipment connected by the network wiring in the field. All work shall comply with the manufacturer’s recommendations, the NEC, and the contract documents.

G. No part of the generator shall be less than 5’ away from the nearest building.

H. Provide a minimum of 36” clear space all around the generator.

3.3 CONNECTIONS

A. Provide all required connections (including, but not limited to, fuel system, cooling system, and exhaust system) in accordance with the manufacturer's recommendations and applicable codes.

B. Ground equipment according to Specification Section "Grounding and Bonding."

C. Connect wiring according to Specification Section "Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Specification Section "Electrical Identification."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
    a. Contractor shall provide a portable load bank for the single-step full-load pickup test. The load bank shall have a capacity not less than the full load capacity of the generator.
    b. Contractor shall provide all temporary electrical connections required for the load test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Provide all the necessary fuel, engine oil, coolant and other liquids required for the generator set testing.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Simulate a power failure by turning off the normal power service disconnect. Verify that the generator starts, the transfer switch transfers, and loads are energized. Simulate return of normal power, by turning the normal power service disconnect back on. Verify that the transfer switch transfers, the generator stops (after cooldown time delay), and the loads are energized.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 MAINTENANCE SERVICE

A. Provide 2 years of maintenance service. Maintenance service shall include, but not be limited, to the following:
   1. Perform all maintenance items recommended by the manufacturer
   2. Perform all the maintenance items required by NFPA 110
   3. Check, replace and top off generator fluids (oil, etc.) during each service visit
   4. Check battery health/strength
   5. Check wire, hose, tubes, and associated connectors for damage
   6. Perform a load bank test on the generator at least once a year, or more frequently if recommended by the manufacturer. The amount of load to be placed on the generator, and the duration of the load bank test; shall not be less than what is recommended by the manufacturer or NFPA 110, whichever is higher.

3.7 SOFTWARE SERVICE AGREEMENT

A. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five (5) years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the lighting control system.

B. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation and maintenance of the installed System.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

D. During the training, the instructor shall provide a laptop that is loaded with the Generator Monitoring and Control Software software, that shall allow the trainees to control/monitor the generator via the internet. At the end of the training, this laptop and all software installed on it, shall become the property of the owner, at no additional cost.

END OF SECTION 263213

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

B. Related Sections include the following:
1. Specification Section " Packaged Engine Generator" for generators, including the requirements for the Generator Monitoring and Control Software, which shall also monitor/control the Automatic Transfer Switch.

C. The transfer switch shall be capable of being remotely monitored and controlled by the Generator Monitoring and Control Software, either through the local area network, or remotely through the internet. Software shall be password protected.

D. The contractor shall provide all labor, programming, materials, equipment, hardware, mounting, wiring, conduit, junction boxes, power supplies, and accessories as required for a complete and fully operational generator and transfer switch power system. The contractor shall provide all startup and testing as required, in order to confirm that the generators and transfer switches operate in accordance with the contract documents. The generators and transfer switches shall comply with all applicable codes, the manufacturer's recommendations, and the requirements of the authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories. Provide size/quantity for all wire lugs/terminals at the equipment.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Qualification Data: For installer and manufacturer

D. Factory test reports

E. Field quality-control test reports.

F. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

G. Screenshots of the following:
1. The Generator Monitoring and Control Software.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate wire terminals/lugs at the equipment with the wires that are connected to it. Wire terminals/lugs shall be suitable for use with the wires that are connected to.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Contactor Transfer Switches:
   a. Caterpillar; Engine Div.
   b. Emerson; ASCO Power Technologies, LP.
   c. Kohler Power Systems; Generator Division.
   d. Onan/Cummins Power Generation; Industrial Business Group.
   e. Spectrum Detroit Diesel.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Environmental Specifications:
   1. Operating Temperature: -4 degrees F to 158 degrees F
   2. Humidity: 5% to 95% noncondensing

B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Transfer switches shall have a withstand and close-on rating of 50,000A, at the supply voltage, when protected by any circuit breaker.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Specification Section "Electrical Identification."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: NEMA 1 metal enclosure, unless otherwise noted.

2.3 AUTOMATIC TRANSFER SWITCH

A. Automatic Transfer Switch shall have the following features:
1. Complies with Level 1 equipment according to NFPA 110.
2. UL 1008 Listed
3. Electrically operated, mechanically held mechanism
4. Fully rated for use as a manual 3-position transfer switch
5. Heavy duty mechanical interlocks
6. Design suitable for emergency and standby applications on all classes of load, 100% tungsten rated through 400 amperes
7. Reliable, field proven solenoid mechanism
8. Switching mechanisms lubricated for life
9. Main shaft auxiliary contacts

B. Automatic Transfer Switch shall be Programmed Transition Type with the following features:
1. Programmed-transition operation provides a center OFF position that allows residual voltages in the load circuits to decay. The time spent in the OFF position shall be field programmable.
2. Programmable OFF time
3. Double-throw, mechanically interlocked design (break both sides)
4. Solid neutral

C. Automatic Transfer Switch Controller shall have the following features:
1. LCD display, 4 lines x 20 characters, backlit
2. Complete programming and viewing capability at the door using the keypad and LCD display
3. LED indicators: Source available, transfer switch position, service required (fault), and “not in auto”
4. Programmable voltage and frequency pickup and dropout settings
5. Programmable time delays
6. Programmable generator exerciser
7. Time-based load control
8. Ethernet connection. The ethernet port is a standard RJ-45 jack.
9. Input/Output (I/O) Module with a minimum of 2 inputs and 6 outputs. The operation of the inputs/outputs shall be programmable.
10. Provide Alarm Module with a minimum of 1 output.
11. Provide 1 pre-transfer signal output contact. The contact shall activate before the transfer switch transfers from normal to generator power and vice versa.
12. Provide 3 post-transfer (to generator) signal output contacts. The contacts shall activate when the transfer switch is connected to generator power.
13. Provide 1 alarm output contact. The contact shall activate when there is an alarm condition at the transfer switch.

D. Automatic Transfer Switch shall have a digital meter with the following features:
   1. Display voltage, current, frequency and power for both sources

E. Automatic Transfer-Switch shall include the following features:
   1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   2. Adjustable Time Delay for engine start: For override of normal-source voltage sensing to delay engine start signals. Adjustable from zero to six seconds, and factory set for one second.
   3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
   4. Time Delay for transfer to Emergency Source: Adjustable from 0 to 30 minutes, and factory set for 1 second.
   5. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
   6. Test Switch: Simulate normal-source failure.
   7. Switch-Position Pilot Lights: Indicate source to which load is connected.
   8. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

      a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
      b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

   9. Unassigned Auxiliary Contacts: Four normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
   10. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
   11. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
   12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
   13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 120 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

      a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
      b. Push-button programming control with digital display of settings.
      c. Integral battery operation of time switch when normal control power is not available.

F. All automatic transfer switch components shall be accessible from the front. Automatic transfer switches which require rear access are not acceptable.

G. Dimensions of the automatic transfer switch shall not exceed 78” high x 34” wide x 24” deep.

H. Weight of the automatic transfer switch shall not exceed 1100 lbs.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identify components according to Specification Section "Electrical Identification."

B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

C. Provide network wiring in 1” minimum conduit, from the automatic transfer switch to the IT network, to allow the automatic transfer switch to be controlled through the local area network, or remotely over the internet. Coordinate the exact location of the generator controller and IT network equipment connected by the network wiring in the field. All work shall comply with the manufacturer’s recommendations, the NEC, and the contract documents.

D. Provide control wiring in 3/4“ minimum conduit, from the automatic transfer switch pre-transfer signal and post-transfer (to generator) signal output contacts, to the elevator controller. These signals shall indicate to the elevator controller, when a transfer of power is about to take place, and when the transfer of power (to generator) has been completed. The elevator controller shall be programmed to recognize these signals, and act accordingly, in order to avoid a sudden loss of power to the elevator while it is in motion; and, to allow only one elevator to operate at any time (if there are 2 or more elevators fed from the transfer switch), when the transfer switch is connected to the generator.

E. Provide control wiring in 3/4“ minimum conduit, from the automatic transfer switch post-transfer (to generator) signal and alarm output contacts, to the generator remote annunciator panel to indicate that when the transfer switch is connected to the generator, and when there is an alarm condition at the transfer switch.

3.2 CONNECTIONS

A. Ground equipment according to Specification Section "Grounding and Bonding."

B. Connect wiring according to Specification Section "Conductors and Cables."

3.3 IDENTIFICATION

A. Identify system components according to Specification Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Perform tests as recommended by the manufacturer.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110
3. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. For programmed transition transfer switches, set the time delay during transition times to allow sufficient time for residual voltages in the load circuits to decay. Do not set the time delay longer than what is needed to achieve this. In no case shall the time delay last longer than the rated backup time of the UPS (Uninterruptible Power Supply) at full load.

D. Coordinate tests with tests of generator and run them concurrently.

E. Report results of tests and inspections in writing. Record adjustable relay settings and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

F. Remove and replace malfunctioning units and retest as specified above.

3.5 MAINTENANCE SERVICE

A. Provide 2 years of maintenance service. Maintenance service shall include, but not be limited, to the following:
1. Perform all maintenance items recommended by the manufacturer
2. Perform all the maintenance items required by NFPA 110
3. Check battery health/strength of integral batteries
4. Check wire associated connectors for damage

3.6 SOFTWARE SERVICE AGREEMENT

A. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five (5) years from date of Substantial

Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the lighting control system.

B. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation and maintenance of the installed System.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

D. During the training, the instructor shall provide a laptop that is loaded with the Generator Monitoring and Control Software, that shall allow the trainees to control/monitor the automatic transfer switch via the internet. At the end of the training, this laptop and all software installed on it, shall become the property of the owner, at no additional cost. The laptop specified in this specification section, and in Specification Section “Packaged Engine Generator”, is the same laptop.

END OF SECTION 263600

SECTION 264113 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes lightning protection systems.

1.3 DEFINITIONS

A. LPI: Lightning Protection Institute.

B. NRTL: National recognized testing laboratory.

C. NEC: National Electrical Code

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by LPI.

D. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.

E. Field inspection reports indicating compliance with specified requirements.

F. The Certified Designer shall provide a complete design for the Lightning Protection System. The design shall comply with all the requirements of NFPA 780 and UL. The design shall include, but not be limited to:
   1. Size and location of main size conductors.
   2. Size and location of bonding conductors.
   3. Size and location of air terminals.
   4. Size and location of supports.
   5. Size and location of connections.
   6. Size and location of intermediate-level interconnection loop conductors.
   7. Size and location of ground loop conductors.
   8. Size and location of ground rods.

9. And all other required hardware and accessories for a complete and fully functional, lightning protection system with a UL Master Label.

G. Provide plan drawings in 1/8” = 1’-0” scale showing size and location of lightning protection system components. The drawings shall be designed by a Lightning Protection Certified Master Designer and the drawings shall bear his seal. The seal shall be current at the time of submission and shall be signed by the Master Designer.

H. Provide UL Master Label Certificate.

I. Provide As-built drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be certified by LPI as a Master Installer.

B. Designer Qualifications: Designer shall be certified by LPI as a Master Designer.

C. The lightning protection system shall conform to the requirements and standards for lightning protection systems of UL and NFPA.

D. Provide UL Master Label Certificate.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

C. Installer shall study all the drawings and submittals to have a complete understanding of all the equipment and structure located on the roof, as well as the overall structure of the building. Installer shall also visit the site to ensure he has a complete understanding of what is required to perform his work.

D. Designer shall review the surge protection devices being provided for this project to ensure that the devices shall comply with UL requirements for obtaining a UL Master Label.

1.7 GENERAL REQUIREMENTS

A. The Lightning Protection System shall be designed by a Lightning Protection Institute (LPI) Certified Master Designer.

B. The system design and installation shall comply with the NEC, NFPA 780, the Lightning Protection Institute (LPI), Underwriters’ Laboratories Inc. (UL), and UL 96A (Installation Requirements for Lightning Protection Systems).

C. The contractor shall furnish all labor, materials, equipment and services to provide a complete lightning protection system. The system shall include strike termination devices, interconnecting

conductors, a proper grounding system, and interconnection with other building grounded systems.

D. The manufacturer of the material components shall be a member of the Lightning Protection Institute, and all materials shall be listed and labeled in accordance with the requirements of UL 96.

E. The system installer shall be certified by LPI as a Master Installer.

F. Upon completion of the installation, the contractor shall deliver to the owner the Master Label of Underwriters' Laboratories, Inc. (UL) and the LPI certified system registration.

G. Provide bi-metallic connectors to connect dissimilar metals.

H. Provide bonding conductors to all equipment that require bonding per NFPA 780

I. Provide lightning protection air terminals per NFPA 780.

J. All underground connections shall be made with exothermic weld connections.

K. All materials shall be UL Listed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Automatic Lightning Protection.
2. ERICO International Corporation.
3. Harger Lightning Protection, Inc.
4. Independent Protection Co.
5. Thompson Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96.

B. Comply with NFPA 780 for size, type and location of the following:
1. Main size conductors
2. Bonding conductors
3. Air terminals. Air terminals shall be UL Listed Blunt Type.
4. Supports
5. Connections
6. Intermediate-level interconnection loop conductors

C. Ground rods shall be Copper-clad steel, ¾ inch diameter by 10 foot long.

D. All underground connections shall use welded connectors. Welded connectors shall be exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATION

A. A Lightning Protection System shall be provided for the building, and mechanical/electrical equipment which are located within 20’ of the building (including, but not limited to, ground mounted Heating, Ventilation, and Air Conditioning Equipment; and, ground mounted Electric Generators).

3.2 INSTALLATION

A. Change to Copper Conductors before entering the ground. Use only copper conductors underground. Use listed bimetallic connectors to connect aluminum and copper conductors. Make transition at 10’ above finished grade.

B. Install lightning protection components and systems according to UL 96A and NFPA 780.

C. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

D. Where Air Terminals are mounted on Single-Ply Membrane Roofing, comply with adhesive manufacturer's and roofing manufacturer’s written instructions. Coordinate with roofing manufacturer and comply with their requirements.

E. Conductors within normal view of exterior locations at grade within 200 feet of the building shall be concealed, unless otherwise noted, and except as follows:

F. Cut and patch existing pavement in the path of the ground loop conductors. Repair existing pavement after conductors have been constructed/installed. The newly repaired pavement shall match the existing pavement.

G. Where down conductors are located at new walls, the down conductors shall run in PVC Schedule 40 conduit (size per NEC), that is concealed within the new walls. Where down conductors are located at existing walls, the down conductors shall run in PVC Schedule 80 conduit (size per NEC), that is exposed on the exterior side of the exterior wall. Exposed conduit shall be painted in a color recommended by the owner/architect. Coordinate exact location of the down conductors with the owner/architect. The entire vertical run of the down conductors shall be installed in conduit.

H. Common Ground Bonding with Lightning Protection System: Comply with the NEC, NFPA 780 and UL 96 when interconnecting with lightning protection system.

I. Furnish and install all required hardware and accessories for a complete and fully functional lightning protection system with a UL Master Label. The required hardware and accessories, include, but are not limited to, the following:
   1. Main size conductors.
   2. Bonding conductors.
   3. Air terminals.
   4. Supports.
   5. Connections.
   6. Intermediate-level interconnection loop conductors.
   7. Ground loop conductors.
   8. Ground rods.

9. Surge Protective Devices.

J. A certified roofing contractor shall inspect all roof work. Roof work shall be performed in a manner that does not void the roofing warranty. Roofing warranty shall be maintained. Provide a certificate indicating that all roof work has been properly performed and that the roofing warranty has been maintained.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.

END OF SECTION 264113

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SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section describes the materials and installation requirements for Surge Protective Devices.

1.3 DEFINITIONS

A. SPD: Surge Protective Device

B. UL: Underwriter's Laboratories

1.4 SUBMITTALS

A. Submit complete product data on all the features and ratings of the devices, including, but not limited to, the following:
   1. Short Circuit Current Rating
   2. Voltage Protection Ratings for all modes
   3. Maximum Continuous Operating Voltage
   4. I-nominal rating (In)
   5. UL File Number
   6. UL Category Code
   7. Provide size/quantity for all wire lugs/terminals at the equipment.

B. Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

C. Field quality control test reports

1.5 COORDINATION

A. Coordinate SPD with the manufacturer of the protected equipment prior to purchase and installation of the SPD to ensure that the surge protector is suitable for its application. Items to coordinate, include, but are not limited to: equipment voltage, maximum continuous operating voltage, frequency bandwidth, and wire connections.

B. Coordinate wire terminals/lugs at the equipment with the wires that are connected to it. Wire terminals/lugs shall be suitable for use with the wires that are connected to.

C. Coordinate SPD with the breaker/circuit it will be connected to. The SPD shall be compatible and suitable for use with the associated breaker/circuit.

1.6 WARRANTY

A. Provide the following warranties in addition to any warranties specified elsewhere in the contract documents:
   1. The manufacturer shall provide a minimum ten-year warranty on all devices and equipment. Warranty coverage shall begin on the date of shipment. The warranty shall cover repair or replacement any defective products within the warranty period.

PART 2 - PRODUCTS

2.1 MAIN SURGE PROTECTIVE DEVICE

A. Provide Square D EMA model series with the following features:
   1. Modular parallel device
   2. Multi-stage suppression circuits consisting of field-proven, fast-acting metal oxide varistors (MOVs)
   3. A surge suppression path is provided for each mode, line-to-neutral (L-N), line-to-line (L-L), line-to-ground, and neutral-to0ground.
   4. Each surge suppression mode is individually fused and uses Thermal Cut-Off (TCO) circuitry to isolate the PSD and ensure shutdown in the event of MOV damage during severe overvoltages, even when operated on high-fault current power systems.
   5. A filter provides EMI/RFI noise attenuation.
   6. On-line diagnostics continuously monitor the device status, and LEDs signal a loss of a suppression circuit. An audible alarm with an enable/disable feature and dry contacts are included in the diagnostic package.
   7. Push-to-test on-line diagnostic display
   8. Front panel alarm with enable/disable switch
   9. Duty cycle tested (ANSI C62.41 C_{high}, 10kA, 20kV) 20,000 impulses
   10. High-energy parallel design for ANSI/IEEE C62.41 and C62.45 category B and C applications
   11. Short Circuit Current Rating: 200kA
   12. EMI/RFI filtering up to -42dB (100kHz to 100MHz)
   13. Sine Wave Tracking
   14. UL 1449 Listed
   15. UL 1283 Listed
   16. NEMA 4X Enclosure
   17. Nominal Discharge Current Rating (In): 20kA
   18. Complies with UL96A and NFPA 780 requirements for surge protective devices used for lightning protection
   19. Surge Protective Device (SPD) Type 1. SPD Type 1 are defined by UL as follows:
      a. Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.

B. Surge Capacity: 240 kA/phase, 120 kA line-neutral, 120 kA line-ground, and 120 kA neutral-ground.

C. Enclosure Dimensions shall not exceed 11.70” wide x 9.4” deep x 22.67” high. Weight shall not exceed 33 lbs.

D. Wire terminals shall be suitable for use with #10through #2 AWG size wiring.

E. SPD shall be suitable for connection to a 30A circuit breaker.

F. The full model number of the SPD shall be coordinated with the associated circuit/equipment. The SPD shall be compatible with the voltage of the circuit/equipment it is connected to.

PART 3 - EXECUTION

3.1 APPLICATION

A. Provide a Main Surge Protective Device for the following locations:
   1. Where the drawings show a surge protective device on the load side of the service disconnect.
   2. Where the drawings show a surge protective device connected to the main distribution panelboard.

3.2 INSTALLATION

A. Install surge protective devices in accordance with the manufacturer’s recommendations, NEC/NFPA 780 requirements, UL’s requirements, and applicable codes.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust, field assembled components and equipment installation, including connections. Report results in writing.

B. Test unit in accordance with manufacturer’s written instructions.

3.4 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain surge protective devices. Provide a minimum of 4 hours of training

END OF SECTION 264313

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SECTION 265119 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior and exterior lighting fixtures, lamps, and ballasts. This includes exterior luminaries mounted on exterior surfaces of buildings.
2. Emergency lighting units.
3. Exit signs.
4. Mini Lighting Inverters

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

E. IES Photometric files for each lighting fixture. Label for the files shall match the labeling of each lighting fixture indicated in the Lighting Fixture Schedule.

F. Color samples

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
    b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type, unless otherwise noted on the drawings
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.4 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type, unless otherwise noted.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 LIGHTING FIXTURES

A. See “Lighting Fixture Schedule” on the Drawings, for the manufacturer and model number of each lighting fixture.

B. Coordinate dimming control type of the lighting fixtures and the lighting controls so that they are compatible and suitable for use with each other.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Specification Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Support fixtures directly from building structure with wires, and provide support clips. For fixtures of sizes less than ceiling grid, support fixtures directly from building structure with wires, and provide metal channels spanning and secured to ceiling tees.
   1. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   3. Install at least four independent support wires from building structure to tabs on the lighting fixture. Locate not more than 6 inches from lighting fixture corners. Wire shall have breaking strength of the weight of fixture at a safety factor of 3. Wires shall be arranged to support the fixture directly from the building structure.

C. Suspended Lighting Fixture Support:

   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Aircraft Cable: Where longer than 24 inches, brace to limit swinging.
   3. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
5. Support fixtures directly from the building structure.
6. Where suspended lighting fixtures are not located directly under roof trusses, roof supports, or other structural elements, provide metal channels to span, or attach to, the roof trusses, roof supports, or other structural elements. Furnish and install metal channels such that the lighting fixtures can be suspended from the metal channels, and installed at the locations required by the contract documents.

D. Lighting Fixtures surface mounted to hard ceilings which have concealed spaces above it:

1. Provide all necessary blocking, channels, and other hardware for securing lighting fixtures to the ceiling, and the building structure as required. The blocking/channels shall be concealed above the hard ceiling. Hard ceilings shall be reinforced as required so that it can handle the weight of the lighting fixtures.

E. Wall-Mounted Lighting Fixture Support:

1. Provide all necessary blocking, channels, and other hardware for securing lighting fixtures to the wall. The blocking/channels shall be concealed inside the hollow spaces of the wall where the wall is gypsum board or other similar wall type.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

G. Adjust aimable lighting fixtures to provide required light intensities.

H. Connect wiring according to Specification Section "Conductors and Cables."

I. Where non-IC rated lighting fixtures are installed in insulated ceilings, provide clearance between the lighting fixture and the insulation in accordance with the manufacturer’s recommendations and NEC requirements.

J. Where non-fire rated lighting fixtures are recessed into fire rated ceilings, build a fire rated enclosure around the lighting fixtures such that a fire in the lighting fixture shall have to pass through the fire rated enclosure and a fire in the ceiling shall have to pass through the fire rated enclosure. The fire rating of the enclosure shall match the fire rating of the ceiling.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting and Mini Lighting Inverters: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the lighting fixtures.

B. The System Supplier shall schedule and present a minimum of 4 hours of documented formalized instruction for the building owner, detailing the proper operation and maintenance of the installed lighting fixtures.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

END OF SECTION 265119

SECTION 271513 – TELECOMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Shop Drawings. A complete set of shop drawings shall be supplied. The shop drawings shall be reviewed and stamped by a RCDD certified person. This package shall include but not be limited to:
   1. Control panel wiring and interconnection schematics. Contractor is responsible for verifying that all the voltages, inputs and outputs are compatible with each other.
   2. Complete point to point wiring diagrams.
   3. Riser diagrams.
   4. Complete floor plan drawing locating all devices and equipment in 1/8” = 1'-0” scale plan. Show the placement of each individual device/equipment as well as raceway size/ routing, junction box size/location, and wire/cable size/type/quantity/color/routing. This includes, but is not limited to, the following:
      a. Cable tray layout
      b. Location of rack in the electrical/telecom room, showing clearances from walls and equipment.
   5. Show elevation drawing of all equipment. This includes, but is not limited to, the following:
      a. Equipment rack elevation.
   6. Detailed system operational description.
   7. Complete system bill of material.

C. Operation and Maintenance Data

D. Field quality control test reports

E. Equipment and cable identification/labelling schedule

F. Qualifications of persons working on the project.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer shall have personnel certified by BICSI on staff
   1. Layout Responsibility: Preparation of Shop drawings by a person certified by BICSI as an RCDD
   2. Installation Supervision: Installation shall be made under the direct supervision of a person certified by BICSI as an RCDD

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff
   1. Testing Agency's Field Supervisor: A person certified by BICSI as an RCDD

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with NECA 1.

1.4 COORDINATION

A. Coordinate the equipment indicated in this specification section with all other equipment and systems it connects to. All input/output/communications interfaces/modules shall be compatible and suitable for use with each other.

B. Coordinate programming of system with the preferences of the owner. Comply with the owner's requirements, except where it conflicts with the applicable codes or the requirements of the authorities having jurisdiction.

C. Where equipment are connected to the data network system, coordinate all network settings/configurations with the owner's IT (Information Technology) department.

D. Coordinate line voltage power requirements prior to starting any work to ensure that power is provided to all equipment. The contractor shall provide line voltage power to all equipment that require it, in accordance with the manufacturer's recommendations and NEC requirements.

1.5 DEFINITIONS

A. BICSI: Building Industry Consulting Services International

B. RCDD: Register Communications Distribution Designer (Certified by BICSI)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Where the contract documents specifies a product name, model, or manufacturer, this product shall be considered as the basis-of-design product. The contractor shall provide the basis-of-design product or approved equal. All products shall be submitted for review and approval by the design team.

2.2 CATEGORY 6 CABLE

A. Provide Category 6 Cable with the following features:
   1. ANSI/TIA Category: 6
   2. Cable Type: Unshielded
   3. Jacket Color: BLUE
   4. Cable shall be Plenum Rated (CMP Type)

5. Remote Powering: Fully complies with the recommendations set forth by IEEE 802.3bt (Type 4) for the safe delivery of power over LAN cable
6. UL Listed

2.3 CATEGORY 5E CABLE

A. Provide Category 5E Cable with the following features:
1. ANSI/TIA Category: 5E
2. Cable Type: Unshielded
3. Jacket Color: WHITE
4. Cable shall be Plenum Rated (CMP Type)
5. Remote Powering: Fully complies with the recommendations set forth by IEEE 802.3bt (Type 4) for the safe delivery of power over LAN cable
6. UL Listed

2.4 TELEHPONE AND/OR DATA OUTLETS

A. Provide Category 5e and 6 jacks in each telephone and/or data outlet.

B. Category 5e jacks shall comply with the following:
1. NASI/TIA Category: 5e
2. UL Listed

C. Category 6 jacks shall comply with the following:
1. NASI/TIA Category: 6
2. UL Listed

D. Wall plates shall comply with the following:
1. Non-metallic
2. UL Listed

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Provide junction boxes as required, in accordance with the NEC and the manufacturer's recommendations.

B. Wiring methods for low voltage (24V or less) power wiring, control wiring, and phone/data/video/audio wiring:
1. Wiring that is exposed, concealed inside walls/floor, or concealed above inaccessible ceilings:
a. All wiring shall be installed in raceway.
2. Wiring that is concealed above accessible ceilings:
a. All wiring shall be installed in raceway, unless otherwise noted and except as follows:
1) Raceway may be omitted where all of the following conditions are met:
a) Wiring is used for Communications Circuits or Class 2 Circuits.
b) Wiring is used in dry locations.
c) Wiring is used in aboveground applications.
d) Wiring is not subject to physical damage.

e) Wiring is supported and secured at intervals which do not exceed 3 feet.
f) Wiring is supported by hangers and supports from the building structure.
g) Wiring is not laid on ceiling tiles.
h) Wiring is not fastened in a manner that puts tension on the wiring.
i) Wiring is plenum rated (UL Type CMP).
j) Wiring is supported by UL Listed Metal J-Hooks (with rounded edges and integral cable retainer metal clip) and secured together with plenum rated nylon straps or clamps (the use of stapes is prohibited).
k) Wiring is concealed above accessible suspended ceilings (this includes, but is not limited to, ceiling spaces above grid type ceilings with removable ceiling tiles).
l) Raceway is not required by the NEC.

C. All junction box covers shall be painted ORANGE, and labeled “DATA”

D. Coordinate electrical power supply connection type with the equipment. Where the equipment requires a receptacle connection, provide a receptacle. Where the equipment requires a hardwired connection, provide a hardwired connection. Coordinate all work with the manufacturer and the installation manuals. All work shall comply with the NEC, the manufacturer’s recommendations, and the contract documents.

E. Where low voltage (24V or less) power wiring, control wiring, and phone/data/video/audio wiring, enter or pass through boxes, enclosures, and furniture/fixtures/equipment, provide grommets and bushings in accordance with the manufacturer’s recommendations and NEC requirements.

3.2 INSTALLATION

A. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

B. Cables shall have a minimum separation of 12 inches from 120V or higher power wiring. Cables shall have a minimum separation of 12 inches from light fixtures.

C. All wall and floor penetrations shall be sleeved. All conduit and sleeve ends must have bushings to prevent chafing. Where a conduit or other through-penetration device is installed through a fire rated assembly, the opening around the sleeve and the hole through the sleeve shall be sealed with an Underwriters Laboratory approved fire rated sealant material after the cables have been installed.

D. Install cables without damaging conductors or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
4. Monitor cable pulling tensions.

G. Install cables parallel and perpendicular to surfaces or structural members and follow surface contours where possible.

H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper telephone and data communication cabling from potential EMI sources, including electrical power lines and equipment.

J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect panels.

K. Use splice and tap connectors compatible with media types.

L. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

M. In the communications equipment room, install a 5-foot- long service loop on each end of cable.

N. Cable support inside wiring closets, telecommunications closets, data closets:
1. Support horizontal and backbone cabling from the fire retardant plywood board in each closet.
2. Provide cable ties and cable tie mounts to support the horizontal and backbone cabling from the plywood board. Provide cable ties every 3”.
3. Cable tie mount shall be manufactured by Panduit or approved equal and shall use galvanized steel screws as the mounting method. Cable tie mount shall be UL Recognized. Cable tie mount size shall be suitable for the cables being supported.

O. Install all devices and equipment in accordance with the manufacturer’s requirements.

P. Prior to installing devices and equipment, the contractor shall coordinate the exact locations where the devices and equipment are being installed with the plan drawings and existing conditions, and shall notify the engineer immediately if there are any issues or conflicts. The coordinated locations shall be indicated in the shop drawing submittals. Where conflicts are found during or after the shop drawing submittal process, but before installation of the devices and equipment, the contractor shall notify the engineer of the conflict, and shall adjust the locations of the devices and equipment, where directed by the engineer to do so. The contractor’s bid price shall include adjusting the locations of devices and equipment up to 12 feet from the locations on the plan drawings, unless otherwise noted.

Q. All equipment shall be installed plumb and level.

R. Clean all equipment in accordance with the manufacturer’s recommendations.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. Provide the following tests and inspections for all cables:
a. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding

for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.

b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

2. Provide the following tests and inspections for Category 5e cables, using test equipment that have been calibrated within the last 12 months prior to the testing (provide proof of calibration)
   a. Wire Map
   b. Length
   c. Propagation Delay
   d. Delay Skew
   e. DC Loop Resistance
   f. DC Resistance Unbalance
   g. Insertion Loss
   h. NEXT (Near-End Crosstalk)
   i. PS NEXT (Power Sum Near-End Crosstalk)
   j. ACR-N (Attenuation to Crosstalk Ratio Near-End)
   k. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
   l. ACR-F (Attenuation to Crosstalk Ratio Far-End)
   m. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
   n. Return Loss
   o. TCL (Transverse Conversion Loss)
   p. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
3. Provide the following tests and inspections for Category 6 cables, using test equipment that have been calibrated within the last 12 months prior to the testing (provide proof of calibration)
   a. Wire Map
   b. Length
   c. Propagation Delay
   d. Delay Skew
   e. DC Loop Resistance – recorded for information only
   f. DC Resistance Unbalance – recorded for information only
   g. Insertion Loss
   h. NEXT (Near-End Crosstalk)
   i. PS NEXT (Power Sum Near-End Crosstalk)
   j. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
   k. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
   l. ACR-F (Attenuation to Crosstalk Ratio Far-End)
   m. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
   n. Return Loss
   o. TCL (Transverse Conversion Loss) – recorded for information only
   p. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only

B. Retesting: Correct deficiencies and retest. Prepare a written record of tests.

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

3.4 IDENTIFICATION

A. Each equipment shall be labeled with an address/identification name/number which matches information provided in the submittals or indicated in the drawings. Identify each cable segment between equipment with a unique number corresponding to the address/identification

name/number of the associated equipment. Provide a cable schedule which identifies each cable segment and the associated equipment.

3.5 DOCUMENTATION AND TRAINING

A. The contractor shall provide to the owner, complete manuals of the completed system. The manuals shall include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams, and a manufacturer's suggested spare parts list.

B. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of eight (8) hours to instruct the owners' designated personnel on the operation and maintenance of the entire system.

C. Training shall be on-site, and hands-on, using the actual equipment installed at the project site.

D. Provide training on how to operate and maintain the system.

END OF SECTION 271513

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SECTION 275123 - INTERCOM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Shop Drawings. A complete set of shop drawings shall be supplied. This package shall include but not be limited to:
   1. Control panel wiring and interconnection schematics. Contractor is responsible for verifying that all the voltages, inputs and outputs are compatible with each other.
   2. Complete point to point wiring diagrams.
   3. Riser diagrams.
   4. Complete floor plan drawing locating all devices and equipment in 1/8” = 1'-0” scale plan. Show the placement of each individual device/equipment as well as raceway size/ routing, junction box size/location, and wire/cable size/type/quantity/color/routing.
   5. Show elevation drawing of all equipment.
   6. Detailed system operational description.
   7. Complete system bill of material.

C. Operation and Maintenance Data

D. System Operation: Provide a detailed description of the system operation, including but not limited to the following:
   1. Indicate when an alarm or supervisory signal is generated.
   2. Indicate what data is stored on the control panel.

E. System Calculations
   1. Provide battery sizing calculations for the standby batteries.

F. Voltage Drop Calculations
   1. Provide voltage drop calculations to show that adequate voltage is provided at each equipment, in order to maintain proper equipment operation.

G. Field quality-control test reports

H. Equipment and cable identification/labelling schedule

I. Qualifications of persons working on the project.

1.3 QUALITY ASSURANCE

A. A Systems Integrator shall integrate all the different components of the system, and shall make sure that the system is complete and fully operational in accordance with the contract documents, and the applicable codes.

B. Systems Integrator Qualifications:
   1. An experienced equipment installer who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, and whose work has resulted in construction with a record of successful in-service performance.
   2. Certified by the equipment manufacturer to perform the work required by the contract documents.
   3. Capable of sizing and selecting different components of the system (including, but not limited to, the wiring) to ensure that all equipment are compatible and suitable for use with each other.
   4. Capable of performing all the calculations required by the manufacturer, industry standards, and the contract documents.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with NECA 1.

1.4 COORDINATION

A. Coordinate the equipment indicated in this specification section with all other equipment and systems it connects to. All input/output/communications interfaces/modules shall be compatible and suitable for use with each other.

B. Coordinate programming of system with the preferences of the owner. Comply with the owner's requirements, except where it conflicts with the applicable codes or the requirements of the authorities having jurisdiction.

C. Where equipment are connected to the data network system, coordinate all network settings/configurations with the owner's IT (Information Technology) department.

D. Coordinate line voltage power requirements prior to starting any work to ensure that power is provided to all equipment. The contractor shall provide line voltage power to all equipment that require it, in accordance with the manufacturer's recommendations and NEC requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Where the contract documents specifies a product name, model, or manufacturer, this product shall be considered as the basis-of-design product. The contractor shall provide the basis-of-design product or approved equal. All products shall be submitted for review and approval by the design team.

2.2 GENERAL

A. The contractor shall provide all labor, software, programming, materials, equipment, hardware, mounting, wiring, conduit, junction boxes, power supplies, transformers, batteries, equipment enclosures (all equipment shall have enclosures), and accessories as required for a complete and fully operational system. The contractor shall provide all startup and testing as required, in order to confirm that the system operates in accordance with the contract documents. The system shall comply with all applicable codes, the manufacturer's recommendations, and the requirements of the authorities having jurisdiction.

B. Intercom System shall be Aiphone JF Series.

2.3 MASTER INTERCOM STATION

A. Provide Aiphone JF-2MED with the following features:
1. Video identification and monitoring with 3-1/2″ screen
2. Hands-free communication
3. Door release
4. All Call between inside stations
5. Surface mounts to wall on 1-gang box or ring
6. Internal Picture Memory
7. Internal voice memo and outgoing message can be recorded for playback
8. 5 display languages (English, French, German, Spanish, or Dutch)

2.4 DOOR INTERCOM STATION

A. Provide Aiphone JF-DV with the following features:
1. Fixed camera provides clear video
2. LED illumination automatically turns on in low light conditions
3. LED backlit nameplate

PART 3 - EXECUTION

A. Provide junction boxes as required, in accordance with the NEC and the manufacturer's recommendations.

B. Wiring methods for low voltage (24V or less) power wiring, control wiring, and phone/data/video/audio wiring:
1. Wiring that is exposed, concealed inside walls/floor, or concealed above inaccessible ceilings:
a. All wiring shall be installed in raceway.
2. Wiring that is concealed above accessible ceilings:
a. All wiring shall be installed in raceway, unless otherwise noted and except as follows:
1) Raceway may be omitted where all of the following conditions are met:
a) Wiring is used for Communications Circuits or Class 2 Circuits.
b) Wiring is used in dry locations.
c) Wiring is used in aboveground applications.
d) Wiring is not subject to physical damage.
e) Wiring is supported and secured at intervals which do not exceed 3 feet.

f) Wiring is supported by hangers and supports from the building structure.
g) Wiring is not laid on ceiling tiles.
h) Wiring is not fastened in a manner that puts tension on the wiring.
i) Wiring is plenum rated (UL Type CMP).
j) Wiring is supported by UL Listed Metal J-Hooks (with rounded edges and integral cable retainer metal clip) and secured together with plenum rated nylon straps or clamps (the use of stapes is prohibited).
k) Wiring is concealed above accessible suspended ceilings (this includes, but is not limited to, ceiling spaces above grid type ceilings with removable ceiling tiles).
l) Raceway is not required by the NEC.

C. All junction box covers shall be painted YELLOW, and labeled “INT”.

D. Coordinate electrical power supply connection type with the equipment. Where the equipment requires a receptacle connection, provide a receptacle. Where the equipment requires a hardwired connection, provide a hardwired connection. Coordinate all work with the manufacturer and the installation manuals. All work shall comply with the NEC, the manufacturer’s recommendations, and the contract documents.

E. Where low voltage (24V or less) power wiring, control wiring, and phone/data/video/audio wiring, enter or pass through boxes, enclosures, and furniture/fixtures/equipment, provide grommets and bushings in accordance with the manufacturer’s recommendations and NEC requirements.

3.2 INSTALLATION

A. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

B. Cables shall have a minimum separation of 12 inches from 120V or higher power wiring. Cables shall have a minimum separation of 12 inches from light fixtures.

C. All wall and floor penetrations shall be sleeved. All conduit and sleeve ends must have bushings to prevent chafing. Where a conduit or other through-penetration device is installed through a fire rated assembly, the opening around the sleeve and the hole through the sleeve shall be sealed with an Underwriters Laboratory approved fire rated sealant material after the cables have been installed.

D. Install cables without damaging conductors or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
4. Monitor cable pulling tensions.

G. Install cables parallel and perpendicular to surfaces or structural members and follow surface contours where possible.

H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Separation of Wires: Comply with TIA/EIA-569-A rules for separating unshielded copper telephone and data communication cabling from potential EMI sources, including electrical power lines and equipment.

J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect panels.

K. Use splice and tap connectors compatible with media types.

L. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

M. In the communications equipment room, install a 5-foot- long service loop on each end of cable.

N. Cable support inside wiring closets, telecommunications closets, data closets:

1. Support horizontal and backbone cabling from the fire retardant plywood board in each closet.
2. Provide cable ties and cable tie mounts to support the horizontal and backbone cabling from the plywood board. Provide cable ties every 3”.
3. Cable tie mount shall be manufactured by Panduit or approved equal and shall use galvanized steel screws as the mounting method. Cable tie mount shall be UL Recognized. Cable tie mount size shall be suitable for the cables being supported.

O. Install all devices and equipment in accordance with the manufacturer’s requirements.

P. Prior to installing devices and equipment, the contractor shall coordinate the exact locations where the devices and equipment are being installed with the plan drawings and existing conditions, and shall notify the engineer immediately if there are any issues or conflicts. The coordinated locations shall be indicated in the shop drawing submittals. Where conflicts are found during or after the shop drawing submittal process, but before installation of the devices and equipment, the contractor shall notify the engineer of the conflict, and shall adjust the locations of the devices and equipment, where directed by the engineer to do so. The contractor’s bid price shall include adjusting the locations of devices and equipment up to 12 feet from the locations on the plan drawings, unless otherwise noted.

Q. All programmable and adjustable settings and sequence of operations shall be coordinated with the owner, and set in accordance with the owner’s recommendations. Where the owner has no preference, provide a recommendation for the owner’s review. Provide eight (8) hours of on-site meetings with the owner, to discuss and make decisions related to the programmable/adjustable settings/sequence of operations. Prior to meeting with the owner on-site, submit a list of items to be discussed, so that the owner is prepared for the on-site discussions.

R. All equipment shall be installed plumb and level.

S. Clean all equipment in accordance with the manufacturer’s recommendations.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust, field assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Test each system in accordance with the manufacturer’s recommendations. Verify that the system is complete and fully operational.

C. Provide the following additional tests and inspections:

1. Verify that each control unit is in normal condition as detailed in manufacturer's operation and maintenance manual.
2. Initiate a call at the door. Verify that the call is received at the master intercom and at a phone with the mobile app. Verify that voice/video is clear at the intercom and at the phones.

D. Retesting: Correct deficiencies and retest. Prepare a written record of tests.

E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

3.4 IDENTIFICATION

A. Each equipment shall be labeled with an address/identification name/number which matches information provided in the submittals or indicated in the drawings. Identify each cable segment between equipment with a unique number corresponding to the address/identification name/number of the associated equipment. Provide a cable schedule which identifies each cable segment and the associated equipment.

3.5 SOFTWARE SERVICE AGREEMENT

A. Provide software technical support as follows:

1. Beginning at Substantial Completion, service agreement shall include software support for two (2) years.
2. Technical support shall include the following:
   a. Toll free technical support via phone
   b. Technical support via the internet

B. Provide software upgrade service as follows:

1. At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
2. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.6 DEMONSTRATION AND TRAINING

A. The contractor shall provide to the owner, complete manuals of the completed system. The manuals shall include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams, and a manufacturer's suggested spare parts list.

B. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of eight (8) hours to instruct the owners' designated personnel on the operation and maintenance of the entire system.

C. Training shall be on-site, and hands-on, using the actual equipment installed at the project site.

D. Provide training on how to operate and maintain the system.

END OF SECTION 275123

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SECTION 283111 - FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, 26, 27, and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

B. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system (System). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (UL) listings.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

C. UL: Underwriter’s Laboratories

D. LCD: Liquid Crystal Display

E. ADA: Americans with Disabilities Act

F. ADA Rooms: Rooms that are specifically reserved for people with disabilities

G. EST: Edwards Systems Technology

H. NAC: Notification Appliance Circuit

I. MC: Metal Clad

1.4 REFERENCES

A. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the Engineer for resolution. National standards shall prevail unless local codes are more stringent. The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the Engineer.

B. System components proposed in this specification shall be UL listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment. The supplier shall be responsible for filing of all documents, paying all fees (including, but not limited to plan checking and permit) and securing all permits, inspections and approvals. Upon receipt of approved drawings from the authority having jurisdiction, the supplier shall immediately forward two sets of drawings to the Owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

C. The equipment and installation shall comply with the current provisions of the following codes and standards:
1. NFPA 70 - 2002 National Electric Code®
2. NFPA 72 - 1999 National Fire Alarm Code®
3. NFPA 90A - 1999 Air Conditioning Systems
4. NFPA 101- 2000 Life Safety Code®
5. UL 864 - Control Units for Fire Protective Signaling Systems.
6. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
7. UL 268A - Smoke Detectors for Duct Applications.
8. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
9. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
10. UL 464 - Audible Signaling Appliances.
11. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
12. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
13. UL 1971 - Signaling Devices for the Hearing-Impaired.
14. UL 1481 - Power Supplies for Fire Protective Signaling Systems.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level IV minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include complete floor plans to indicate equipment and device locations. The address of each addressable device shall be indicated on the floor plans. Show type, size and route of cable and conduits. Floor plans shall be drawn in 1/8” = 1’-0” scale.
7. All drawings shall be reviewed, stamped and signed by an individual having a minimum of a NICET Level IV certification in fire protection engineering technology, subfield of fire alarm systems.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.
7. Complete documentation of system testing.
8. Certification that the entire system has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and UL listings, and is in proper working order.
9. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Fire Alarm System as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and

programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically documented by the system.

10. Provide all drawings in standard .DXF format. A bond paper plot of each sheet shall also be provided.
11. Project specific operating manuals covering the installed Life Safety System. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
12. The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).
13. Provide the name, address and telephone of the authorized factory representative.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

H. A copy of the Fire Alarm System submittal shall be provided to the Permits Department and to the Fire Marshall. Resubmit as required to make clarifications or revisions to obtain approval.

I. Equipment and cable identification/labelling schedule

J. Qualifications of persons working on the project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. The contractor shall coordinate with the AHJ and the Fire Marshal. The contractor shall provide all certifications, testing, and other requirements that are required by the AHJ and the Fire Marshal. All certifications, testing, and other requirements which are required by the AHJ and the Fire Marshal shall be included in the contractor’s bid price.

1.7 COORDINATION

A. Fire alarm system manufacturer shall coordinate wiring and conduit layout and requirements with the Electrical Contractor.

B. Keys for the locks and switches shall be coordinated with the owner and the Fire Department.

C. Comply with the requirements for the Fire Marshall, the Elevator Safety Inspector and the Authority Having Jurisdiction. Program the fire alarm control panel as required.

1.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
3. Keys and Tools: One extra set for access to locked and tamperproofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

B. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

C. Edwards Systems Technology, Inc. products constitute the minimum type and quality of equipment to be installed.

D. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based, system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

E. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Edwards Systems Technology (EST), (Contact Ark Systems Inc. at 410-995-1220)

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate alarm system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.
3. Carbon monoxide detection.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Ground or a single break in fire-alarm control unit internal circuits.

4. Abnormal ac voltage at fire-alarm control unit.
5. Break in standby battery circuitry.
6. Failure of battery charging.
7. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Annunciate at fire-alarm control unit and remote annunciators. Transmit trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL PANEL AND FUNCTIONS

A. The control panel shall be a multi-processor-based system designed specifically for fire and releasing system applications. The control panel shall be listed and approved for the application standards as listed under the General section.

B. The control panel shall include all required hardware, software and system programming to provide a complete and operational system. The control panel shall assure that life safety takes precedence among all panel activities.

C. The control panel shall include the following capacities:
1. Support up to 380 analog/addressable points per panel (1,900 total with 5 networked panels).
2. Support up to 576 chronological events in history.
3. Support up to 5 fully supervised network remote annunciators.
4. Support a DACT (dialer) for off premise notification
5. The control panel shall include the following features:
   a. Provide auto-programing and electronic addressing and mapping of analog/addressable devices.
   b. Provide an operator interface display that shall include functions required for annunciation, command and control system functions.
   c. Provide a discreet system control switch provided for reset, alarm silence, local silence, drill switch, up/down switches, status switch, program switch, enable and disable switches, activate and restore switches, reports switch and test switch.
   d. Provide system reports that provide sensitivity and history details.
   e. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords; and autoprogram, enable mapping, restart the system and clear control panel event history file.
   f. Provide an authorized operator to perform test functions within the installed system.
6. Supervision of system components, wiring, initiating devices and software shall be provided by the control panel. Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and processor operation shall be independently monitored for failure.

D. ANNUNCIATION
1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Manufacturer's standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the owner is required.
2. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device.
3. The annunciator shall contain the following system status indicators:

a. 80 character Backlit Liquid Crystal Display.
b. System Power Indicator – green LED
c. System Common Alarm – red LED
d. System Common Trouble – yellow LED
e. System Common Supervisory – yellow LED
f. System Common Monitor – yellow LED
g. System Ground Fault – yellow LED
h. System CPU Fault – yellow LED.
i. System Disabled – yellow LED.
j. System Test Point(s) – yellow LED.
k. System Reset Switch with Integral yellow LED.
l. System Alarm Silence Switch with Integral yellow LED.
m. System Local Silence Switch with Integral yellow LED.
n. System Drill Switch with Integral yellow LED.
o. System Message Queue Scroll Switches.
p. Additional buttons as required to provide system control and operator functions.

E. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. The display module shall be of membrane style construction with a 4 line by 20 character Liquid Crystal Display. The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicator that lights when an event of its type is active. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.
2. The display module shall be an EST model 2-LCD.

F. Circuits:

1. Initiating Device Circuits:
   a. The Initiating device circuits (IDC) used to monitor manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B (Style "A" or "B").
   b. The Initiating device circuits shall be EST Signature series modules.
2. 24 VDC Notification Appliance Circuits:
   a. 24 VDC Notification appliance circuits (NAC) shall be Class B (Style "Y"). All notification appliance circuits shall have a minimum circuit output rating

of 2 amp @ 24 vdc. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

b. The 24 VDC Notification appliance circuits shall be EST Signature series modules

3. Signaling Line Circuits:
   a. The signaling line circuit shall communicate from a panel/node to analog/addressable detectors, input modules, output modules, isolation modules and notification appliance circuits.
   b. Each signaling circuit connected to addressable/analog devices shall provide a minimum of 20 spare addresses. When a signaling line circuit covers more than one fire/smoke compartments, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments. The signaling line circuit (SLC) connecting panels and annunciators shall be Class B (style 4).
   c. The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, and notification circuit modules shall be Class B (style 4).

4. Serial Interfaces: Two RS-232 ports for printers.

G. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.

   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway (top of elevator shaft and in the elevator pit)

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. A heat detector alarm and/or a water-flow alarm connected to sprinkler in an elevator shaft (top of elevator shaft and in the elevator pit) and elevator machine room shall shut down elevators associated with the location without time delay.

H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries shall be sealed and maintenance free.

N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

O. Digital Alarm Communicator and Transmitter:
1. The panel shall have a dialer (alarm communicator transmitter (DACT)) module to transmit alarm, supervisory and trouble signals to a Central Monitoring Station (CMS). The DACT shall support dual telephones lines, 20 PPS 4/2 communications, and configured for dual tone multi-frequency (DTMF) or pulse modes. It shall be possible to delay AC power failure reports, auto test call, and site program using a touch tone phone and password.
2. The dialer shall be an EST model DL2.

P. Display
1. System Message Processing and Display Operations:
   a. The system shall allow message routing to be configured to any or all annunciators.
   b. All system printer port shall be configurable to output any combination of alarm, supervisory, trouble, or monitor, event messages.
   c. Each LCD display on each annunciator shall be configurable to display the status of any combination of alarm, supervisory, trouble, or monitor, event messages.
   d. Clear distinction shall be provided between alarm, supervisory, trouble, and monitor status messages.
   e. The system shall provide the ability to retrieve data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The uploaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.
   f. A standby power supply shall automatically supply electrical energy to the system upon primary power supply failure.

Q. Reports
1. The system shall provide the operator with system reports that give detailed chronological description of the last 576 system events. The system shall provide a report that gives a listing of the sensitivity and environmental compensation usage of all of the detectors on the system, or specified analog/addressable circuit.
2. The system report shall also include facility name, compiled date, compiler revision, project revision and report date. The system shall output these reports via the main LCD, and reports shall be capable of being printed on the system printer.

R. Battery backup:

1. The entire fire alarm system shall have a battery backup system. Batteries shall be sized for 24 hours of standby followed by 15 minutes of alarm. Provide an additional 20% spare battery capacity on top of that.

2.4 BOOSTER POWER SUPPLIES

A. The booster supply must incorporate four independent supervised Notification Appliance Circuits. It shall be possible to configure the NACs to follow the main panel's NAC or activate from intelligent Signature Series modules. The booster NACs must be configurable to operate independently at any one of the following rates: continuous; 120 SPM; or, 3-3-3 temporal. Fault conditions on the booster shall not impede alarm activation of host NAC circuits.

B. Fault conditions detected by the power supply shall open the main fire alarm control panel's NAC. This initiates a trouble condition and eliminates the need to wire a separate trouble signal back to the control panel.

C. Power supply shall have an enclosure.

D. Battery backup shall be provided.

E. Booster Power Supplies shall be EST BPS Series with enclosure and battery backup.

2.5 MANUAL FIRE-ALARM BOXES

A. Provide analog/addressable single action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of metal construction and incorporate an internal toggle switch. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers.

B. The analog/addressable single action, single stage fire alarm stations shall be EST model SIGA-270.

2.6 SYSTEM SMOKE DETECTORS

A. Analog Addressable Smoke General
   1. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive.
   2. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event.
   3. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 80% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% compensation has been used.
   4. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector

type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

B. Smoke Detector – Photoelectric
1. Smoke detector shall be analog/addressable photoelectric smoke detector type.
2. The system shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value.
3. The analog/addressable photoelectric smoke detector shall be an EST model SIGA-PS.

C. Duct Detector Housing
1. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel.
2. A remote key-operated test station with built-in alarm LED indicator shall be provided for each duct smoke detector.
3. The smoke detector duct housing shall be an EST model SIGA-DH.

2.7 SYSTEM HEAT DETECTORS

A. Heat detector shall be analog/addressable combination fixed temperature / rate-of-rise detector type.

B. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F(9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

C. The analog/addressable combination fixed temperature / rate-of-rise detector shall be EST model SIGA-HRS.

2.8 DETECTOR BASES

A. Provide standard detector mounting bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA

or 1-gang box. The base shall, contain no electronics and support all series detector types.

B. The standard detector base shall be an EST model SIGA-SB.

2.9 NOTIFICATION APPLIANCES

A. General (signals)
1. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessabilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
2. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
3. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended. All strobes shall be provided with lens markings oriented for wall mounting.
4. All notification appliances shall be red unless noted otherwise on the drawings.
5. The word “FIRE” shall be engraved on the devices.
6. Provide weatherproof devices where indicated on the drawings.

B. Horns
1. The horn shall have a minimum of 2 field selectable settings for dBA levels. Horn shall be UL Listed under Standard 464.

C. Speaker
1. The speaker shall have a minimum of 4 field selectable settings for dBA levels. Speaker shall be UL Listed under Standard 1480.

D. Strobes
1. The strobe shall have switch selectable settings for light output. Output shall be rated per UL Standard 1971 for 15, 30, 75 and 110 candela. Strobes shall provide synchronized output.

E. Horn-Strobe
1. The combination device shall consists of a horn and a strobe.
   a. The horn shall have a minimum of 2 field selectable settings for dBA levels. Horn shall be UL Listed under Standard 464.
   b. The strobe shall have switch selectable settings for light output. Output shall be rated per UL Standard 1971 for 15, 30, 75 and 110 candela. Strobes shall provide synchronized output.

F. Speaker-Strobe
1. The combination device shall consist of a speaker and a strobe.
   a. The speaker shall have a minimum of 4 field selectable settings for dBA levels. Speaker shall be UL Listed under Standard 1480.
   b. The strobe shall have switch selectable settings for light output. Output shall be rated per UL Standard 1971 for 15, 30, 75 and 110 candela. Strobes shall provide synchronized output.

2.10 INITIATION AND CONTROL MODULES

A. Intelligent Modules – General
1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing

B. Control Relay Module
1. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc (0.5 amps at 120VAC) to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.
2. The addressable control relay circuit module shall be an EST model SIGA-CR.

C. Dual Input Module
1. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types:
   a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
   c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
   d. Normally-Open Active Latching (Supervisory, Tamper Switches
2. The intelligent dual input module shall be an EST model SIGA-CT2.

D. Isolator Module
1. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.
2. The intelligent fault isolator module shall be an EST model SIGA-IM.

E. Single Input Module
1. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:
   a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)

b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
d. Normally-Open Active Latching (Supervisory, Tamper Switches)

2. The intelligent single input module shall be an EST model SIGA-CT1.

F. Single Input Signal Module

1. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The single input signal module shall support the following operations:
   a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)
2. The intelligent single input signal module shall be an EST model SIGA-CC1.

G. Dual Input Signal Module

1. The Dual Input (Dual Riser Select) Signal Module shall provide two (2) supervised Class B output circuits capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The dual input signal module shall support the following operations:
   a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)
2. The intelligent single input signal module shall be an EST model SIGA-CC2.

H. Multi-Voltage Control Relay

1. The relay is encapsulated multi-voltage device providing 10 amp form C contacts. The relay may be energized by one of three input voltages: 24VAC, 24VDC or 115VAC.
2. The relay shall support the following operations:
   a. To be provided as required to switch larger currents that cannot be handled by other devices.
   b. To monitor 24VDC voltage.
3. The relay shall be EST model PAM-1.

2.11 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24VDC. Provide power to the door holder from the fire alarm system 24VDC power supplies.
4. Material and Finish: Match door hardware.

2.12 FIRE ALARM ANNUNCIATOR PANEL

A. The annunciator panel shall include an LCD Display mounted inside the enclosure. LCD shall have 4 lines of 20 characters per line. Display shall be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm or supervisory functions.

B. Provide fire alarm graphic annunciator panels where graphic panels are required by the drawings.

2.13 FIRE ALARM DOCUMENTS BOX

A. Fire Alarm Documents Box shall Space Age Electronics, Inc Fire Alarm Storage Cabinet RED with the following features:
   1. The documents box shall be UL listed, constructed of 18 gauge cold rolled steel. It shall have a red powder coat epoxy finish. The cover shall be permanently screened with 1” high lettering “FIRE ALARM DOCUMENTS” with white indelible ink. The access door shall be locked with a 3/4” barrel lock and the hinge shall be a solid width 12” stainless steel piano hinge. The enclosure will supply 4 mounting holes. Inside the enclosure will accommodate standard 8 1/2” x 11” manuals and loose document records that will be protected within the enclosure. A legend sheet will be permanently attached to the door for system required documentation. Key contacts and system information. The documents box will have securely mounted inside a minimum of 4 Gigabyte digital flash memory drive with a standard USB B connector for uploading and downloading information. The drive shall not be accessible without tools to any person whom gains access to the records. The enclosure shall also provide 2 key ring holders with a location to mount standard business type cards for key contact personnel.
   2. The items that shall be stored in the documents box include, but are not limited to, the following: fire alarm software, business cards for fire alarm system installer, test records, inspection records, service records, systems records, manuals, and folded as-built drawings of the fire alarm system.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Where the project includes an elevator, provide the following modules:
   1. Provide 2 control modules per elevator, one to recall the elevator to the primary floor and one to recall the elevator to the alternate floor.
   2. Provide 1 control module to activate the firefighter’s hat flash.
   3. Provide 1 monitor module to monitor the shunt trip voltage for the elevator.
   4. Provide 1 control module to shunt trip the power feeder for the elevator.

B. Air Handling Unit Shutdown:
   1. Duct smoke detectors shall include housing, sampling tube, smoke detector, and remote key-operated test station (with built-in alarm LED indicator). Provide wiring as recommended by the manufacturer in 3/4” conduit from duct smoke detector to remote test station. Remote test station shall be located in an accessible location that can easily be seen.
   2. Provide a control module to interlock with the Air Handling Unit.

C. Provide booster power supplies and audio power supplies as required or as indicated. Field install circuit breakers as required to provide power to the booster panels. Provide branch circuit wiring (2#12 & #12G in 1/2" conduit, minimum) to feed power to the power supply. Install power supplies in an accessible location. Do not install above the ceiling.

D. Comply with NFPA 72 for installation of fire-alarm equipment.

E. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

F. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

H. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Comply with NFPA 72.

I. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

J. Circuit disconnecting means (circuit breaker) for the Fire Alarm Control Panel shall have a red marking, and shall be identified as "FIRE ALARM CIRCUIT".

K. Circuit disconnecting means (circuit breaker) for the Fire Alarm power supplies and other fire alarm system components that require 120VAC shall have a red marking, and shall be identified as "FIRE ALARM - XXX", where "XXX" is the description of the equipment.

L. The location of the circuit disconnecting means (circuit breaker) feeding the Fire Alarm Control Panel shall be permanently identified at the Fire Alarm Control Panel.

M. All strobes shall flash in synchronization. Provide synchronization modules as required.

N. Provide fire alarm documents box adjacent to the fire alarm control panel.

O. Prior to installing devices and equipment, the contractor shall coordinate the exact locations where the devices and equipment are being installed with the plan drawings and existing conditions, and shall notify the engineer immediately if there are any issues or conflicts. The coordinated locations shall be indicated in the shop drawing submittals. Where conflicts are found during or after the shop drawing submittal process, but before installation of the devices and equipment, the contractor shall notify the engineer of the conflict, and shall adjust the locations of the devices and equipment, where directed by the engineer to do so. The contractor's bid price shall include

adjusting the locations of devices and equipment up to 12 feet from the locations on the plan drawings, unless otherwise noted.

3.2 CONNECTIONS

A. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

3.3 IDENTIFICATION

A. Each equipment shall be labeled with an address/identification name/number which matches information provided in the submittals or indicated in the drawings. Identify each cable segment between equipment with a unique number corresponding to the address/identification name/number of the associated equipment. Provide a cable schedule which identifies each cable segment and the associated equipment.

B. Install framed instructions in a location visible from fire-alarm control unit.

C. Junction box covers shall be painted red.

D. Fire alarms cables shall be red in color.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by the authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
7. Using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4, field verify that the measured sound level (during a fire alarm condition) in each room, space or area complies ADA and NFPA 72 requirements. Record the measured sound level in each room, space or area, and indicate if it complies with ADA and NFPA 72 requirements. If it does not comply, provide written recommendations in order to fix the deficiency.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

D. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

E. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

END OF SECTION 283111

SECTION 311000 - SITE CLEARING

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees indicated to remain.

2. Removal of trees and other vegetation.

3. Topsoil stripping.

4. Clearing and grubbing.

5. Removal and disposal of pavement areas, inclusive of pavement base courses, sidewalk, curb, and combination curb and gutter.

6. Removal of above-grade improvements pertains to those shown on the drawings and all those existing improvements readily visible at the site and in the drawings which interfere with the work.

7. Removing below-grade improvements pertains to those items shown on the drawings, and those associated with the above grade improvements to be removed, if they impede the proposed work.

8. Removal and/or abandonment of utilities and appurtenances.

1.3 DEFINITIONS

A. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

B. Critical Root Zone: As a distance of three feet equal distance from the truck, for each inch of trunk diameter.

1.4 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. The Contactor shall provide Maintenance of Traffic (MOT) in accordance with the requirements of Baltimore City Department of Public Works.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner's property.

2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Soil Erosion and Sediment Control: Soil erosion and sediment control measures are required for this site in accordance with the approved plans. Soil erosion and sediment control measures disturbed or damaged by clearing operations shall be restored to operating condition in accordance with the requirements of the approved plan before the end of each working day.

D. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bar, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.

2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.

3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.

4. Replace trees that cannot be replaced and restored to full-growth status, as determined by arborist.

5. Do not direct vehicle or equipment exhaust towards tree protection zones.

6. Prohibit heat sources, flames, ignition sources and smoking within or near tree protection zones.

E. Improvements on Adjoining Property: Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by Owner prior to award of contract.

1. Extent of work on adjacent property is indicated on Drawings.

F. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed. Refer to Division 01 Section "Construction Waste Management and Disposal."

1.5 EXISTING SERVICES

A. General: Indicated locations are approximate, determine exact locations before commencing Work.

B. Arrange and pay for disconnecting, removing, capping, and plugging of utility services. Notify affected utility companies in advance and obtain approval before starting this Work.

C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 SITE CLEARING

A. The contractor shall prepare and submit a demolition/construction staging plan to Baltimore City Department of General Services for approval prior to beginning any construction. Refer to Division 01 Section "Construction Waste Management and Disposal."

B. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

C. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1/2 inch in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

b. Precut roots of trees to remain prior to excavating soil near trees to be saved on site or existing trees offsite.

2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.

D. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface.

2. Use only hand methods for grubbing inside drip line of trees indicated to remain.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

a. Place fill material in horizontal layers not exceeding 8 inches loose depth, and thoroughly compact each layer to a density not less than 90 percent of the maximum dry density when tested in accordance with ASTM D-1557.

E. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Removal of pavement, including base courses, sidewalk, curb, and combination curb and gutter, shall be for the full depth thereof.

2. Existing foundations shall be removed in their entirety.

3. The Contractor shall use suitable equipment, tools, and methods for cutting and trimming as well as removing the materials to the neat lines set by the Owner and shall not in any manner disturb or damage the sections of base or pavement to be salvaged.

4. Damage done by the Contractor’s equipment or methods to those areas designated for salvaging shall be replaced at the Contractor’s expense.

5. Where the old subgrade is satisfactory as to condition and elevation, special care shall be taken in the removal operation in order to avoid the disturbing of the old grade.

6. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings and is included under work of related Division 15 and 16 Sections. Removing abandoned underground piping or conduits interfering with construction shall be as follows:

a. Underground improvements shall be completely removed to a depth of two feet below indicated subgrade under structures and paving or finished grade in other areas or where it conflicts with proposed construction.

b. Pipes and other utilities indicated to be abandoned in place shall have open ends plugged with concrete for a minimum length of one foot. Structures, manholes, and other utility appurtenances shall be filled with compacted subgrade materials.

7. Fill depressions caused by clearing and grubbing and removal of improvements with satisfactory material, unless further excavation or earthwork is indicated.

3.2 DISPOSITION OF UTILITIES

A. Verify with the Authority having jurisdiction that utility lines indicated to be removed or abandoned are no longer in service before beginning removal or abandonment.

B. Relocation of Utilities: Where utility services (which include water, sewer, storm drains, electrical, gas, telephone, etc.) are to be relocated as a part of the work of this contract, the Contractor shall maintain the existing utility services in service until the relocated services have been completed and approved. The Contractor shall coordinate with the Authority having jurisdiction to make temporary service connections, re-route services and make all tie-ins as may be required.

C. Unknown Utilities: Where utilities are encountered in the work, the presence of which is not shown or indicated on the drawings, the Contractor shall immediately notify the Authority having jurisdiction. The Contractor shall maintain these unknown utility services until instructed by the Authority having jurisdiction as to the proper disposition of the utility.

3.3 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner’s Property: Burning is not permitted on Owner’s property.

B. Removal from Owner’s Property: Remove waste materials and unsuitable or excess topsoil from Owner’s property and dispose of off-site in accordance with local regulations.

3.4 RECORD DRAWINGS

A. Survey and include on record drawings location and depth of all utilities encountered which have not been removed.

END OF SECTION 311000

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SECTION 312300 - EXCAVATING, FILLING & GRADING

1.1 RELATED DOCUMENTS:

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated January, 2008 and as amended.

E. 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended

1.2 DESCRIPTION

A. This Section includes the following:

1. Backfilling operation to bring the existing site to grade.

2. Preparing and grading sub grades to slabs-on-grade, walks, pavements, and landscaping.

3. Excavating and backfilling for buildings and structures.

4. Drainage and moisture-control fill course for slabs-on-grade.

5. Subbase course for walks and pavements.

6. Subsurface drainage backfill for walls and trenches.

7. Excavating and backfilling trenches within building lines.

8. Excavating and backfilling for underground utilities and appurtenances.

B. Related Sections:

1. Section 311000: Site Clearing

2. Section 312319: Dewatering

3. Section 329000: Planting

4. Section 033310: Cast-in-Place Site Concrete

5. Section 312500: Soil Erosion and Sediment Control

1.3 SOIL INVESTIGATION DATA

A. Investigation:

1. Geotechnical Engineering Study, Forest Park Library, 3023 Garrison Blvd., Baltimore, MD 21216, dated May 10, 2024, and all additional soil borings and updates to said report. Prepared by D.W. Kozera, Inc. Contract Number 22223.D

B. Subsurface Soil Data:

1. Data concerning subsurface materials or conditions, which is based upon test pits, or test borings, shall be obtained by Owner, the Architect, and the Engineers for their own use in designing the project. Its accuracy or completeness is not guaranteed by the Owner, the Architect or the Engineers, and Contractor must assume all responsibility in excavating for this project and shall not rely on subsurface information obtained from Architect, or Engineers, or indirectly from the Owner. Bidders shall make their own investigation of existing subsurface conditions. Neither the Owner, the Architect, or the Engineers will be responsible in any way for additional compensation for excavation work performed under the Contract, due to Contractor's assumptions based on subsoil data prepared solely for the Owner, the Architects, and the Engineers, use.

C. A copy of the results of the subsurface investigation has been included under Section 00900, Available Information, for informational purposes only.

1.4 DEFINITIONS

A. Excavation: the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material off-site when sufficient approved soil material is not available from on-site excavations.

D. Recycled Material: Recycled Material shall contain a minimum of 90% post-consumer material.

E. Subbase Course: The layer between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

F. Base Course: The layer placed between the subbase and surface pavement in a paving system.

G. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

H. Unauthorized excavation: the removing of materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

I. Additional excavation: When excavation has reached required subgrade elevations, notify the Inspection Agency, who will make an inspection of conditions. The Contractor is responsible for scheduling the inspections such that there is no delay in the Project. If the Inspection Agency determines that bearing material at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by them.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

K. Utilities: on-site underground pipes, conduits, ducts, and cable, as well as underground services within building lines.

L. Rock Excavation in Trench Excavation and Pits, including continuous wall footings and individual column footings, shall consist of:

1. The removal of/and disposal of solid rock, ledge rock, rock hard cementitious materials and/or boulders ½ cubic yards or more in volume in trench excavations less than 10 feet in width and pits less than 30 feet in either length or width.

2. Excavation of materials that required the use of:

a. Excavating equipment which exceeds standard Earth Excavating Equipment as defined herein.

b. Systematic drilling.

c. Hand-held or backhoe mounted pneumatic hammers

3. Blasting will only be permitted after receiving permission from the owner and local authorities. The Contractor shall obtain special liability insurance to protect all parties, including the Owner and Engineers from all claims resulting from any blasting.

M. Rock Excavation in open excavation (all excavations other than trench excavation and pit excavation) shall consist of the following:

1. The removal and disposal of solid rock, ledge rock, rock hard cementitious material and/or boulders 2 cubic yards or more in volume.

2. Excavation of materials that requires the use of:

a. Excavation equipment which exceeds standard Earth Excavation Equipment as defined herein.

b. Systematic drilling.

c. Hand-held or backhoe mounted pneumatic hammers.

3. Blasting will not be permitted.

N. The Contractor is advised that minimum standard earth excavation equipment is defined as follows:

1. For Trench Excavation as defined herein: 250 H.P., track mounted, hydraulic excavator with a 3-foot rock bucket.

2. For Open Excavation as defined herein: 280 H.P. crawler dozer with a single shank ripper.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Each type of warning tape.

2. Filter fabric.

3. Recycled materials.

4. Requirements for local material source.

C. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources, including classification per ASTM D2487.

2. One moisture density curve for each soil material, per AASHTO T-180.

3. Reports of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Land surveyor.

2. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the State of Maryland.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.8 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of Authorities having jurisdiction.

B. Testing and Inspection Service: The Owner will engage a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing during earthwork operations and to check bearing capacities of excavated footings to confirm required bearing capacity prior to installation of reinforcing steel and concrete.

1.9 PROJECT CONDITIONS

A. Backfilling below-grade areas: The backfilling operation required to bring actual grades to the grade elevations shown on the drawings as existing grades.

1. The borrow material shall be removed and then either stored or disposed. If the testing agency verifies that the borrow material complies with these specifications for backfill material, then the Contractor may use it to backfill this area to grade.

2. Any additional backfill material necessary to complete this operation shall comply with these specifications.

3. This backfilling operation shall be the first earthwork operation performed on site after establishment of the sediment control devices.

B. Site Information: Data in subsurface investigation reports was used for the basis of the design. The data in the subsurface investigation report is not a part of the Contract. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner, Architect or Engineers will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

1. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor’s option; however, no change in the Contract Sum will be authorized for such additional exploration.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided. If said existing utilities are indicated to be

abandoned, the Contractor shall remove such utility, if necessary, at no additional cost to the Owner.

1. Provide a minimum 48-hours-notice to the Architect and receive written notice to proceed before interrupting any utility.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

E. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

F. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Open excavation within the roadways shall be plated and shall be posted with warning devices in accordance with the Manual of Uniform Traffic Control Devices.

1. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

2. Work which affects the public right-of-way shall be in accordance with the Baltimore City requirements and regulations.

G. Moisture Sensitive Soils:

1. The on-site founding materials are moisture sensitive and will be easily disturbed by excessive construction activity.

2. The exposed founding materials shall be protected against detrimental changes in engineering qualities as a result of disturbance from rain or frost.

3. Surface runoff shall be drained away from the excavations and not allowed to pond.

4. If possible, concrete shall be placed in the footings the same day the excavations are made, or the founding materials may be covered by mud mats in order to protect the founding soil from becoming saturated due to forecasted precipitation and/or disturbed due to excessive construction activity during the placement of steel reinforcement.

5. The presence of moisture sensitive fine-grained soils poses the potential for high moisture content. Soils may be found to be at or near their plastic limit; consequently, the on-site soils may require discing, aeration, and/or manipulation to achieve efficient compaction.

6. Any regions exhibiting poor drainage characteristics, and low lying areas, shall be expected to display moisture contents which are excessively high for normal earthwork operations.

7. Any standing water shall be drained or pumped into approved sediment control facilities prior to commencement of earthwork.

8. Excavations near to subgrade and all fills should be protected from traffic of heavy equipment, including heavy compaction equipment, when on-site soils exhibit high moisture contents, in order to minimize pumping and a generalized deterioration of these materials.

H. The Contractor is solely responsible for the protection of the sub-grade until it receives final surface treatment and shall maintain the sub-grade as suitable and acceptable to the Owner or Owner's Representative at all times. He shall be completely responsible for restoration or replacement of the sub-grade due to moisture damage, construction traffic, or any other cause. Repair or replacement of the sub-grade shall be performed at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Classification of materials shall be made by the Owners independent testing agency.

1. Provide subbase and backfill manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

B. Satisfactory Soil Materials: ASTM D 2487 soil classified as SM, SP, SW, GM, GP, and GW; free of rock or gravel large than 3 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of Silty Sand (SM), or more granular, in accordance with ASTM D 2487. Based on the boring results, the majority of the on-site material is unsuitable as structural fill. It is recommended that structural fill be imported.

C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups CL, ML, MH, CH, OL, OH, and PT.

D. Backfill and Fill Materials: Satisfactory soil materials. See geotechnical report.

E. Subbase and Base Material: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940. Graded aggregate for subbase courses shall meet the requirements for G A S/B as shown in Table 312300-1. Recycled concrete (RC-6) should not be used under the building and stormwater management facilities, but may be used for sidewalks and roadway repair.

Table 312300-1

SIEVES		MASS PERCENT PASSING	
Mm	Standard	BRG S/B	G A S/B
100	4 in.		
90	3.5 in.		
63	2.5 in.	100	
50	2 in.		100, ± 3
37.5	1.5 in.		90 - 100, ± 5
25	1 in.	90 - 100	
19	¾ in.		
12.5	½ in.	60 - 100	
9.5	3/8 in.		
4.75	#4		30 - 60, ± 10
2.36	#8		
2.0	#10	35 - 90	
0.60	#30		
0.425	#40	20 - 55	
0.075	#200	5 - 25	0 - 12, ± 5

F. Engineered Fill: Subbase or base materials.

G. Bank Run Gravel for subbases: Bank Run Gravel for subbase courses shall meet the requirements for BRG S/B as shown in Table 31 23 00-1.

H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, AASHTO M43, coarse aggregate grading size 57, with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 8 sieve.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1 inch sieve and 0 to 5 percent passing a No. 50 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

K. Recycled Content of Backfill: Provide recycled concrete (RC-6) for temporary roads, subbase, pipe bedding, and fill material, except under the building slab. Recycled aggregates shall contain a minimum of 90% post-consumer aggregate content.

L. Regional Materials: Provide aggregate and sand products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red: Electric

b. Yellow: Gas, oil, steam, and dangerous materials

c. Orange: Telephone and other communications

d. Blue: Water Systems

e. Green: Sewer Systems

B. Filter Fabric: Manufacturer’s standard nonwoven previous geotextile fabric of polypropylene, nylon, or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4759 and the referenced standard test method in parentheses:

a. Grab Tensile Strength (ASTM D 4362): 100lb.

b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.

c. Permeability (ASTM 4491): 150 gallons per minute per sq. ft.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I Type II or Type III.

2. Fly Ash: ASTM C 618, Class C or F.

3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.

4. Foaming Agent: ASTM C 869.

5. Water: ASTM C 94.

6. Air-Entraining Admixture: ASTM C 260.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Tree protection is specified in the Division 31 Section 311000 - “Site Clearing.”

3.2 DEWATERING

A. Provide dewatering for the site in accordance with Division 31 Section 312319 – “Dewatering”.

3.3 BACKFILLING BELOW-GRADE AREAS

A. Completely fill below-grade areas and voids resulting from the demolition of the site improvements and pavements with compacted fill, as described below, to the grades as shown as existing grades on the drawings. All backfilling operations must be performed in accordance with the Geotechnical report, including all protective measures related to the building foundations, utility trenches, etc.

1. Use satisfactory soil materials, as defined by ASTM D 2487, classified as SM, SP, SW, GM, GP, and GW; free of rock or gravel large than 3 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of Silty Sand (SM), or more granular, in accordance with ASTM D 2487. Based on the boring results, the majority of the on-site material is unsuitable as structural fill. It is recommended that structural fill be imported.

2. Prior to placement of compacted structural fill, the fill subgrade should be stripped of organic layers and then proof rolled under the observation of the Owners Testing Agency or Geotechnical Engineer of Record to identify any unsuitable soft and loose soils. A minimum 20-ton dump truck should be used for proof rolling at a speed of less than 2 feet per second. Areas of subgrade that exhibit pumping or contain organic material should be removed down to firm, natural soils and then replaced with satisfactory soil materials.

3. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. In building and pavement areas, fill should be compacted to 95% of the maximum density when tested in accordance with ASTM D 698, Standard Proctor. Compacted fill in lawns and unpaved areas may be compacted to 90% of the maximum dry density when tested in accordance with ASTM D 698, Standard Proctor. Fill materials should be placed at moisture contents within 3 percentage points of the optimum moisture content. No compacted fill shall be placed unless a soils technician is present to monitor fill compaction.

B. Testing Agency shall verify compliance of borrow material at both the in-situ location and after the material has been brought to the site.

3.4 EXCAVATION

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

3.5 STABILITY OF EXCAVATIONS

A. Due to the depth of the existing partial basement, proximity to existing structures (public areas, and roads), and the intent to preserve the historic building, it is important that any earthwork, excavation support, wall bracing, and underpinning be coordinated. This will require the Structural, Geotechnical, and Specialty Contractor Engineers to work together to address the unique aspects of this portion of the project. Due to the historic nature of the existing structure as well as its close proximity, it is generally recommended that Support of Excavation (SOE) and underpinning solutions be considered by the design and construction team to be implemented using techniques that will limit vibrations to tolerable levels.

B Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

C. Slope sides of excavation to comply with local codes, ordinances, and requirements of authorities having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

D. Shoring and bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period that excavations will be open. Extend shoring and bracing as excavation progresses.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within tolerance of plus or minus ½ inches. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspection.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Appurtenances: Excavate to elevations and dimensions indicated within a tolerance of plus or minus ½ inches. Do not disturb bottom of excavations intended for bearing surface.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevation and grades.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels, of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.

1. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bells of loads and ensure continuous bearing of pipe barrel on bearing surface.

3.9 UNAUTHORIZED EXCAVATION

A. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without

altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.

B. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Architect.

3.10 APPROVAL OF SUBGRADE

A. Notify Geotechnical Engineer of Record when excavations have reached required subgrade.

B. When Geotechnical Engineer of Record determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust as necessary.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for record documents.

3. Testing, inspecting, and approval of underground utilities.

4. Concrete formwork removal.

5. Removal of trash and debris from excavation.

6. Removal of temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.13 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on unyielding bearing surface and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to a level of 4 inches above bottom of footings.

C. Provide 4 inch thick concrete base slab support for piping or conduit less than 30 inches below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum 4 inches of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles large than 1 inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up to both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.

B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. Provide minimum 4 inches of drainage fill below all slabs. Drainage fill shall be either washed gravel or an open-graded crushed stone with 95-100 percent passing a 1 inch sieve and less than 12 percent passing a No. 200 sieve. Place in a single layer and compact to a minimum of 95 percent of the maximum dry density, as determined by the Modified Proctor compaction test method ASTM D 1557. Overlay fill with vapor barrier, such as Stego wrap, between slab and drainage fill.

3.15 SUBSURFACE DRAINAGE BACKFILL

A. Subsurface Drain: Place a layer of filter fabric around perimeter of drainage trench or at footing, as indicated. Place a 6-inch compacted course of filtering material on filter fabric

to support drainage pipe. After installing and testing, encase drainage pipe in a minimum of 12-inches of compacted filtering material consisting of open graded natural stone (i.e. #57 stone) and wrap in filter fabric, overlapping edges at least 6-inches.

B. Impervious Fill: Place and compact impervious fill material for top 12" to final subgrade.

3.16 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstruction, and deleterious materials from ground surface prior to placing fills.

1. Plow strip, or break up sloped surface steeper than 1 vertical 4 horizontal so fill material will bond with existing surface. Compact all surfaces with a minimum 10-ton smooth drum or sheepsfoot roller.

B. When subgrade or existing ground surface to receive fill has density less than required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1. Under grass, use satisfactory borrow soil material.

2. Under walks, pavements, and footings use subbase or base material, or satisfactory borrow soil material.

3. Under steps and ramps, use subbase material.

4. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

3.17 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

3.18 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations to prevent wedging action. Place backfill and fill uniformly along the full length of each structure.

C. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698 (Standard Proctor):

1. Under structures, building slabs, steps, compact the top 12 inches of fill materials below subgrade to 95 percent maximum density. Each layer of backfill or fill material below the top 12 inches should be compacted to 90 percent maximum dry density.

2. Under pavement, compact the top 12 inches of fill materials below subgrade to 95 percent maximum density. Each layer of backfill or fill material below the top 12 inches should be compacted to 90 percent maximum dry density.

3. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum density.

4. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum density.

E. Proof roll all areas which are to receive pavements and slab-on-grade for the proposed building with vehicle having a minimum axle load of 20 tons. Unsuitable materials shall be removed and replaced with new compacted fill.

F. When existing ground surface has a density less than that specified under “Compaction” for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

3.19 GRADING

A. General: Uniformly grade areas to a smooth surface free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 2 inches.

2. Walks: Plus or minus 2 inches.

3. Pavements: Plus or minus 2 inches

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 2 inches when tested with a 10-foot straightedge.

3.20 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of ASTM D 4254 relative density.

2. Shape subbase and base to required crown elevations and cross-slope grades.

3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.

4. When thickness of compacted subbase or base course exceed 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulder along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.21 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared subgrade.

1. Compact drainage fill to required cross sections and thickness,

2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.

3. When compacted thickness of drainage exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.22 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks weekly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.

1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.

2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection.

D. Testing Agency Service: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field-in-place density tests according to ASTM D 1556 (sand cone method).

a. Field-in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

b. When field-in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each difference type of material encountered, and at intervals as directed by the Engineer.

2. Footing Subgrade: Inspect bearing state at each column footing and at twenty foot intervals in wall footings, at the footing subgrade, to verify required bearing capacity.

3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2000 sq. ft. or less of paved areas or building slab, but in no case fewer than three tests.

4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of wall length, but no fewer than two tests along a wall face.

5. Trench Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of trench, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. Retesting will be paid by the Contractor.

3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and re-compact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Contractor shall remove and dispose of offsite all excess topsoil and/or borrow remaining after final grading has been completed.

1. Remove waste material, including unsatisfactory soil trash, debris, and legally dispose of off the Owner’s property.

END OF SECTION 312300

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SECTION 312319 - DEWATERING

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.

2. Section 312300 "Excavating, Filling & Grading" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.

3. Review geotechnical report.

4. Review proposed site clearing and excavations.

5. Review existing utilities and subsurface conditions.

6. Review observation and monitoring of dewatering system.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.

2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer registered in Maryland responsible for their preparation.

C. Qualification Data: For Installer and professional engineer.

D. Field quality-control reports.

E. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

F. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of the Owner.

1.6 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project by D.W. Kozera, Inc. Contractor shall employ a geotechnical engineer as necessary, to be approved by the owner, to render opinions and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.

2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

3. Prevent surface water from entering excavations by grading, dikes, or other means.

4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified on the approved plans.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.

2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

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SECTION 312500 - SOIL EROSION AND SEDIMENT CONTROL

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

D. Sediment and Stormwater Administration Maryland Department of the Environment, 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, dated December 2011, and addendum thereto.

1.2 SUMMARY

A. The extent of soil erosion and sediment control facilities is shown on the Erosion and Sediment Control Plans, approved by Baltimore City.

1.3 QUALITY ASSURANCE

A. Comply with local codes where applicable and to the requirements of all permits.

B. Comply with the provisions outlined in Division 1.

PART 2 PRODUCTS

2.1 MATERIALS REQUIREMENTS

A. Material requirements are specified on the drawings.

PART 3 EXECUTION

3.1 GENERAL

A. Installation of the soil erosion and sediment control facilities shall be as shown and specified on the Sediment/Erosion Control Plans and Detail sheets of the Contract Drawings.

3.2 TIMING

A. All perimeter controls shall be installed and approved by the Sediment Control Inspector as specified in the “Sequence of Construction” on the Contract Drawings.

3.3 MAINTENANCE

A. All soil erosion and sediment control measures shall be maintained continuously during the construction period.

B. Soil erosion and sediment control measures shall be inspected daily, and any measure which has been disturbed or damaged shall be repaired and restored to operating condition in accordance with the approved plans before the end of each working day.

3.4 REMOVAL

A. Soil erosion and sediment control measures shall not be removed until the removal has been authorized by the Sediment Control Inspector.

END OF SECTION 312500

SECTION 313116 - TERMITE CONTROL

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes soil treatment for termite control.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and application instructions.

C. Certification that products used comply with US Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

D. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore City Standard Specifications and Details, or other guidelines set forth by the authorities having jurisdiction the more stringent will apply.

1.5 JOB CONDITIONS

A. Restrictions

1. Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operation.

2. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather.

3. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites.

1. If subterranean termite activity if discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

2. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation.

1. Fuel oil will not be permitted as a diluent.

2. Provide a solution consisting of one of the following chemical elements.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.

b. Bayer Corporation; Premise 75.

c. Dow AgroSciences LLC; Dursban TC.

d. FMC Corporation, Agricultural Products Group; Talstar, Prevail FT Torpedo.

e. Syngenta; Demon TC.

C. Dilute with water to concentration level recommended by manufacturer.

D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction.

E. Use only soil treatment solutions that are not harmful to plants.

PART 3 EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application shall not take place if rain is forecasted within a 24-hour period.

C. Application Rates: Apply soil treatment solution as follows:

1. Under slab on-grade structures, treat soil before concrete slabs are placed, using the following application rates:

    a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

    b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 12 gallons of chemical solution per 10 sq. ft. to areas where fill is washed gravel or other coarse absorbent material.

    c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each 12 inches of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is replaced in the trench.

2. At hollow masonry foundation or grade beams, treat voids at a rate of 2 gallons per 10 linear feet poured directly into the hollow spaces.

3. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet of penetration.

D. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 313116

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SECTION 315000 - EXCAVATION SUPPORT

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:

1. Section 013233, "Photographic Documentation," for recording preexisting conditions and excavation support and protection system progress.

2. Section 312300, "Excavation, Filling & Grading, " for excavating and backfilling and for controlling surface-water runoff and ponding.

3. Section 312319, "Dewatering," for dewatering excavations.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review existing utilities and subsurface conditions.

2. Review coordination for interruption, shutoff, capping, and continuation of utility services.

3. Review proposed excavations.

4. Review proposed equipment.

5. Review monitoring of excavation support and protection system.

6. Review coordination with waterproofing.

7. Review abandonment or removal of excavation support and protection system.

1.4 SUBMITTALS

A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.

2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.

3. Indicate type and location of waterproofing.

4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

B. Qualification Data: For Installer and Professional Engineer.

C. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

E. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.5 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project by D.W. Kozera, LLC. Contractor shall employ a geotechnical engineer as necessary, to be approved by the owner, to render opinions and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.

2. The geotechnical report is included elsewhere in Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.6 SOIL INVESTIGATION DATA

A. Investigation:

1. Geotechnical Engineering Study, Forest Park Library, 3023 Garrison Blvd., Baltimore MD, 21216 dated May 10, 2024, prepared by D.W. Kozera, Inc. Contract Number 22223.D.

B. Subsurface Soil Data:

1. Data concerning subsurface materials or conditions, which is based upon test pits, or test borings, has been obtained by Owner, the Architect, and the Engineers for their own use in designing the project. Its accuracy or completeness is not guaranteed by the Owner, the Architect or the Engineers, and Contractor must assume all responsibility in excavating for this project and shall not rely on subsurface information obtained from Architect, or Engineers, or indirectly from the Owner. Bidders shall make their own investigation of existing subsurface conditions. Neither the Owner, the Architect, or the Engineers will be responsible in any way for additional compensation for excavation work performed under the Contract, due to Contractor's assumptions based on subsoil data prepared solely for the Owner, the Architects, and the Engineers, use.

C. A copy of the results of the subsurface investigation has been included under Section 00900, Available Information, for informational purposes only.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

A. General: Provide materials that are either in new or serviceable condition.

B. Structural Steel: ASTM A 36, ASTM A 690, or ASTM A 992.

C. Steel Sheet Piling: ASTM A 328, ASTM A 572, or ASTM A 690; with continuous interlocks.

1. Corners: Site-fabricated mechanical interlock.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Tiebacks: Steel bars, ASTM A 722.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and local Authority. Provide alternate routes around closed or obstructed traffic ways if required by Owner and/or local Authority.

C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

2. Install internal bracing if required to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions

for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."

3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

SECTION 321200 - FLEXIBLE PAVING

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2023 and as amended.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching
3. Hot-mix asphalt overlays.
4. Asphalt surface treatments:
    a. Fog seals
    b. Slurries
5. Multi-purpose court seal coating.
6. Pavement-marking paint.

B. Related Sections:

1. Section 312300: Excavating, Filling & Grading
2. Section 321300: Rigid Paving
3. Section 321723: Pavement Marking

1.3 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the Baltimore City Standards and the Standard Specifications

for Construction and Materials of the Maryland Department of Transportation, State Highway Administration, latest edition, are hereby by reference made a part of these specifications where applicable.

B. Bituminous concrete pavement shall consist of aggregate asphalt mixed and constructed in accordance with these specifications and placed to the depth, grade, and cross section shown on the Construction Details.

1.4 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: For each job mix proposed for the Work.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.

D. Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

F. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

A. Installed Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacture Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-services performance.

1. Firm shall be a registered and approved paving mix manufacturer with the Baltimore City Department of Public Works or with the Maryland State Highway Administration.

C. Testing Agency Qualifications: The Owner will engage a qualified independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

E. Asphalt-Paving Publication: Comply with AI’s “The Asphalt Handbook”, except where more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 40° F.

2. Slurry Coat: Comply with weather limitations of ASTM D 3910.

3. Asphalt Base Course: Minimum surface temperature of 32° F and rising at time of placement.

4. Asphalt Surface Course: Minimum surface temperature of 40° F at time of placement.

B. Pavement-marking Paint: Apply pavement marking on clean, dry surfaces as specified at the manufacturer's recommended ambient, surface and material temperatures.

1.8 SOIL INVESTIGATION DATA

A. Investigation:

1. Geotechnical Engineering Study, Forest Park Library, 3023 Garrison Blvd., Baltimore MD, 21216, dated May 10, 2024, prepared by D.W. Kozera, Inc. Contract Number 22223.D

B. Subsurface Soil Data:

1. Data concerning subsurface materials or conditions, which is based upon test pits, or test borings, has been obtained by Owner, the Architect, and the Engineers for their own use in designing the project. Its accuracy or completeness is not guaranteed by the Owner, the Architect or the Engineers, and Contractor must assume all responsibility in excavating for this project and shall not rely on subsurface information obtained from Architect, or Engineers, or indirectly from the Owner. Bidders shall make their own investigation of existing subsurface conditions. Neither the Owner, the Architect, or the Engineers will be responsible in any way for additional compensation for excavation work performed under the Contract, due to Contractor's assumptions based on subsoil data prepared solely for the Owner, the Architects, and the Engineers use.

C. A copy of the results of the subsurface investigation has been included under Section 00900, Available Information, for informational purposes only.

PART 2 PRODUCTS

2.1 AGGREGATES

A. General: Use locally available, extracted within 500 mile radius of Project Site, materials and gradation that exhibit a satisfactory record of previous installations. Bituminous concrete shall meet the requirements of the S.H.A. Specifications, Section 904, as later specified herein or as indicated on the drawings.

B. Coarse Aggregate: Sound, angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag, complying with ASTM D 692-88.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag; or combination thereof, complying with ASTM D 1073.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Recycled Content: Provide maximum reclaimed asphalt pavement (RAP) as feasible.

E. Regional Materials: Provide aggregate products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

2.2 ASPHALT MATERIALS

A. Asphalt Cement: ASTM D 3381 for viscosity-graded material, ASTM D 946 for penetration-graded material.

B. Undersealing Asphalt: ASTM D 3141, pumping consistency.

C. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.

D. Tack Coat: ASTM D 977, emulsified asphalt.

E. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

D. Provide Crusher Run (CR-6) subbase and fill material.

2.4 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot- mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Base Course: Hot mix Asphalt Superpave 19.0 mm – PG 64-22 Level 2.

2. Surface Course: Hot mix Asphalt Superpave 9.5 mm – PG 64-22 Level 2 .

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 COLD MILLING

A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.

1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.

2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.

2. Remove disintegrated or badly broken pavement. Prepare and patch with hot-mix asphalt.

C. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

D. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of ¼ inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

E. Tack Coat: Apply uniformly to existing surface of previously constructed asphalt or Portland cement concrete paving to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.01 to 0.05 gal./sq. ft. of surface.

1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer’s recommended rates and written application instructions. Apply to dry, prepared subgrade or surface or compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3. Prime coat shall be applied at a temperature of 75° F to 100° F.

3.5 HOT-MIX ASPHALT PLACING

A. Bituminous concrete shall not be placed when the ambient air and surface temperature is below 40° F. When the surface temperature falls below these limits, material enroute may be placed at the risk of the Contractor.

B. Apply prime and tack coats when ambient temperature is above 40° F and when temperature has not been below 32° F for 12 hours immediately prior to applications. Do not apply when base is wet or contains an excess of moisture.

C. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thickness indicated.

2. Place hot-mix asphalt surface course in single lift.

3. Spread mix at minimum temperature of 225° F.

4. Begin applying mix on high side of one-way slopes, unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

D. Place paving in consecutive strips no less than 10 feet wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.

E. Promptly correct surface irregularities in pacing course behind paver. Use suitable hand tools to remove excess material forming high spots. File depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.

2. Offset longitudinal joints in successive course a minimum of 6 inches.

3. Offset transverse joints in successive course by the length of the paver.

4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI’s “The Asphalt Handbook.”

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

B. Longitudinal and transverse joints shall be made in a careful manner.

1. Well bonded and sealed joints are required. If necessary, in order to obtain this result, joints shall be painted with asphalt.

2. Both longitudinal and transverse joints in successive courses shall be staggered so as not to be one above the other.

3. Longitudinal joints shall be staggered a minimum of 6 inches and shall be arranged so that the longitudinal joint in the top course being constructed shall be at the location of the lane dividing the traffic lanes.

C. Joints between old and new pavements, or between successive days work, shall be carefully made in such a manner as to ensure a thorough and continuous bond between old and new surfaces.

1. In the case of surface courses, the edge of the old and new surface course shall be cut back for its full depth so as to expose a fresh surface.

2. To obtain a well bonded joint, the surface shall be painted with hot asphalt, after which the hot surface mixture shall be placed in contact with it and raked to a proper depth and grade.

3. Before placing the mixture against them, all contact surfaces, of curbs, gutters, headers, manholes, etc., shall be painted with a thin uniform coating of hot asphalt cement or asphalt cement dissolved in Naptha.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools below 185° F (85° C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joint and outside edge. Examine surface immediately after breakdown rolling for indicated grade, and smoothness, Repair surface by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to an in-place density of 92.0 to 97.0 percent of the maximum density.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over are affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled to less than 140° F or as directed by the Engineer.

3.8 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch

2. Surface Course: 1/8 inch

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry to smooth ridges and provide a uniform, smooth surface.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Prime asphalt surfaces with sealer, as recommended by thermoplastic material manufacturer based on surface conditions. Include adhesive or adhesion promoter when asphaltic surfaces exhibit polished aggregate.

E. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 30 mils.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor’s expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of un-compacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D1559, and compacted according to job-mix specifications.

a. One core sample will be taken for every 100 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.

b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A. All excavated and demolished material shall be removed from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321200

SECTION 321300 - RIGID PAVING

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes exterior Portland cement concrete paving for the following:

1. Curbs and gutters.

2. Walkways.

B. Related Sections:

1. Section 312300: Excavating and Filling

2. Section 033310: Cast-in-Place Site Concrete

3. Section 321723: Pavement Marking

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specifications Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Laboratory test reports for evaluation of concrete materials and mix design tests.

E. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificate shall be assigned by manufacturer and Contractor certifying that each material item complies with or exceed requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

1.4 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, “Specifications for Structural Concrete for Buildings.”

2. ACI 318, “Building Code Requirements for Reinforced Concrete.”.

3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice.”

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: The Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

D. Regional Materials: Provide aggregate products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

E. Repair / Replacement Policy:

1. Only those permits or projects that have less than ten (10%) percent of damaged curb and gutter (C&G) sections, will be considered for repair rather than replacement. (Eligibility for repair is covered in subsequent paragraphs.) If the ten percent rule is exceeded, the repair option is forfeit and all damaged section of C&G on the job will be removed and replaced. Example: a street permit of 800 linear feet (1600’ of C&G) would be allowed to have a maximum of 160 feet of damaged C&G. At 10 feet per average block, this would equal sixteen sections. (Damage is defined in Section 1.3)

2. The same formula (percentage of linear feet) would apply against sidewalk (S/W), though naturally the blocks or sections would be based on the four (4) or five (5) foot sections as applicable. Inlet throats and driveway/utility aprons will not be a consideration in the eligibility requirements

3. The maximum allowable chip, gouge, etc., will be six (6”) inches in the longest dimension. Any defect(s) larger than six inches will be considered as a non-repairable defect, and the entire block, section, or other subject structure will be slated for removal and replacement. (Note: if damage to only half of a driveway apron has occurred, only the damaged half need to be replaced by methods outlined in Paragraph 6. Chips or other slight imperfections of less than one and one-half (1 ½”) inches in the longest dimension will not be considered as detrimental and therefore will not be a factor. The depth of the damaged area is not to be considered in the evaluation. In the same vein, the presence of structural integrity, or lack thereof, in a specific piece of concrete will not be a basis for judgement or discussion. This premise would include all types of and/or sizes of defects or damages.

4. When a permit/project does qualify for repair, the areas to be patched shall meet the following criteria:

a. The patch has to blend in with the original or surrounding area of concrete in color and texture, as well as conform to the adjoining area in configuration (shape). Since some products undergo color changes during the curing process, time will be granted for color matching based on the specific product manufacturer's performance data.

b. The areas repaired will be subjected to a durability test and have to meet with the inspector's satisfaction. The test for durability and adhesion will be conducted by a moderate blow with a 16 oz. hammer. Any deviation or failure of any portion(s) of the above listed requirements will be cause for automatic rejection of the repair process. The resulting alternative will be to remove and replace all damaged sections on the permit/project in question

5. The following examples of damage will not be considered for repair but will fall under the guidelines as sections to be removed and replaced.

   a. Any evident cracks (including hairline) that permeate the exposed surface area(s) of the structure. (Inlet throats are exempt – see 5d.)

   b. Any areas of the finished concrete exhibiting signs of spalling.

   c. Curb and gutter or sidewalk sections damaged by long scars, six (6") inches or more in length, that are deep enough to expose the aggregate.

   d. Cracks in inlet throats will be allowed (based on the additional strength afforded by the use of steel reinforcement), provided the cracks are only hairline in nature and not differential and only occur at either, or both ends (wall areas), of the inlet.

6. In some cases, where damage has occurred to two adjoining pieces of C&G (if both on their merits would be subject to replacement) the removal and replacement of the damaged portions of each section would be acceptable, provided the new section of the damaged portions of each section will still meet the five foot minimum, thirteen foot maximum block requirement. The joints at the damaged areas would be required to be cut with a concrete saw and the defective portions removed and replaced without further damage to the adjoining concrete.

7. The following example of damage is not included in, or constrained by, the previously detailed guidelines:

   a. When the section(s) of C&G are damaged on the vertical face of the gutter pan (rolling of base asphalt, grading, etc.), the following criteria will apply:

      1) The loss of concrete shall not exceed one-half (½") inch, as measured horizontally from the edge of the gutter where it meets the asphalt, toward the face of the curb.

      2) In this case, the otherwise acceptable section(s) shall be treated in the following manner:

         a) The damaged area(s) must be thoroughly cleaned and coated with an epoxy sealer.

b) Upon completion of the 2" bituminous concrete surface course, the longitudinal joint formed by the asphalt and the gutter pan at the damaged section(s) must be sealed with bituminous asphalt joint sealer.

When the loss of concrete exceeds the one-half (½") inch dimension previously mentioned, the damaged sections must be removed and replaced.

F. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore City Standard Specifications and Details, or other guidelines set forth by the authorities having jurisdiction the more stringent will apply.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.6 SOIL INVESTIGATION DATA

A. Investigation:

1. Geotechnical Engineering Study, Forest Park Library, 3023 Garrison Blvd., Baltimore MD, 21216, dated May 10, 2024, prepared by D.W. Kozera, Inc. Contract Number 22223.D

B. Subsurface Soil Data:

1. Data concerning subsurface materials or conditions, which is based upon test pits, or test borings, has been obtained by the Owner, the Architect, and the Engineers for their own use in designing the project. Its accuracy or completeness is not guaranteed by the Owner, the Architect or the Engineers, and Contractor must assume all responsibility in excavating for this project and shall not rely on subsurface information obtained from Architect, or Engineers, or indirectly from the Owner. Bidders shall make their own investigation of existing subsurface conditions. Neither the Owner, the Architect, or the Engineers will be responsible in any way for additional compensation for excavation work performed under the Contract, due to Contractor's assumptions based on subsoil data prepared solely for the Owner, the Architects, and the Engineers, use.

C. A copy of the results of the subsurface investigation has been included under Section 00900, Available Information, for informational purposes only.

PART 2 PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

B. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 fL volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

1. Recycled Content: Provide steel with minimum 90 percent total recycled content, including at least 60 percent post-consumer material.

2. Regional Materials: Provide steel manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

B. Welded Steel Wire Fabric: ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.

C. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with end square and free of burrs.

D. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Supports for Reinforcement: Chairs, spacers, dowel bar supports, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.

1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I, white. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Regional Materials: Provide aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

C. Aggregate for Exposed Concrete Pavement: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Size: 1/2 inch nominal.

2. Aggregate Shape, and Color: Rounded, earth tone (white, beige, brown) color.

D. Solar Reflectance Index (SRI) of Concrete Paving: Minimum value of 29.

E. Water: Potable.

2.4 ADMIXTURES

A. Provide concrete admixtures that contain no more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Air-Entraining Admixture:

a. Air-Tite or Amex 210; Cormix Construction Chemicals.

b. Air-Mix or Perma-Air; Euclid Chemical Co.

c. Darex AEA or Daravair; W.R. Grace & Co.

d. MB-VR or Micro-Air, Master Builders, Inc.

e. Sealtight AEA; W.R. Meadows, Inc.

f. Sika AER; Sika Corp.

2. Water-Reducing Admixture:

a. Chemtard; ChemMasters Corp.

b. Type A Services; Cormix Construction Chemicals

c. Eucon WR-75; Euclid Chemical Co.

d. WRDA; W.R. Grace & Co.

e. Pozzolith Normal or Polyheed; Master Builders, Inc.

f. Metco W.R.; Metalcrete Industries

g. Plastocrete 161; Sika Corp.

2.5 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Available Products:

a. Axim Concrete Technologies; Cimfilm.

b. Burke by Edeco; BurkeFilm.

c. ChemMasters; Spray-Film.

d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.

e. Dayton Superior Corporation; Sure Film.

f. Euclid Chemical Company (The); Eucobar.

g. Kaufman Products, Inc.; Vapor Aid.

h. Lambert Corporation; Lambco Skin.

i. L&M Construction Chemicals, Inc.; E-Con.

j. MBT Protection and Repair, ChemRex Inc.; Confilm.

k. Meadows, W. R., Inc.; Sealtight Evapre.

l. Metalcrete Industries; Waterhold.

m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.

n. Sika Corporation, Inc.; SikaFilm.

o. Symons Corporation; Finishing Aid.

p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Available Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.

b. Burke by Edoko; Aqua Resin Cure.

c. ChemMasters; Safe-Cure Clear.

d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.

e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).

f. Euclid Chemical Company (The); Kurez DR VOX.

g. Kaufman Products, Inc.; Thinfilm 420.

h. Lambert Corporation; Aqua Kure-Clear.

i. L&M Construction Chemicals, Inc.; L&M Cure R.

j. Meadows, W. R., Inc.; 1100 Clear.

k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.

l. Symons Corporation; Resi-Chem Clear.

m. Tamms Industries Inc.; Horncure WB 30.

n. Unitex; Hydro Cure 309.

o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Liquid Membrane-Forming Curing Compound:

a. Clear Cure; Anti-Hydro Co., Inc.

b. Spartan-Cote; The Burke Co.

c. All Resin; Conspec Marketing & Mfg. Co.

d. Sealco 309; Cormix Construction Chemicals

e. Day-Chem Cure and Seal; Dayton Superior Corp.

f. Diamond Clear; Euclid Chemical Corp.

g. #64 Resin Cure-Clear; Lambert Corp.

h. L&M Cure R; L&M Construction Chemicals

i. Masterkure; Master Builders, Inc.

j. 3100 Series; W.R. Meadows, Inc.

k. Seal N Kure; Metalcare Industries

l. Kure-N-Seal; Sonneborn-Chemrex

m. Horn Clear Seal; Tamms/A.C. Horn

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the Owner’s field quality-control testing agency as the independent testing agency.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 3000 psi minimum

2. Maximum Water-Cement Ratio at Point of Placement: 0.45

3. Slump Limit at Point of Placement: 4 inches, plus or minus 1 inch.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete required to be watertight and concrete with a water-cementitious materials ratio below 0.50.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Ground Granulated Blast-Furnace Slag: 50 percent.

3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

E. Fiber Reinforcement: Add to mix at a rate of 1/5 lb per cu. yd., unless manufacturer recommends otherwise.

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project condition, weather, test results, or other circumstances warrant.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1. When air temperature is between 85° F and 90° F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90° F, reduce mixing and delivery time to 60 minutes.

2.9 JOINT MATERIALS

A. Zip strip control joint manufactured by Superior Featherweight Tools, Inc. or approved equal.

B. Performed Joint Fillers

1. The cork type shall be in accordance with AASHTO M153.

2. The bituminous fiber type shall be in accordance with AASHTO M213 with the bituminous content determined by AASHTO T164.

3. The weathering test shall be deleted for either type of material.

C. Roofing paper to be used in construction joints shall be composed of roofing felt saturated and coated on both sides with an asphaltic material. It shall not weigh less than 39.8 lbs/square foot and shall not crack when bent over 1/2 inch radius at room temperature.

2.10 JOINT SEALANTS

A. Compatibility: Sealant fillers and all adjacent materials shall be compatible as demonstrated by sealant manufacturer testing.

B. Colors - Provide color of exposed joint sealants to comply with the following:

1. Match colors of concrete.

C. Cold Applied Joint Sealants shall be one part, polyurethane-base sealant for concrete pourable, chemically curing elastomeric formulation complying with the following requirements relative to formulation with ASTM C 920 for Type S, Grade NS, Class 25, and Uses indicated.

2.11 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates; sealants, primers, and other joint fillers, and are approved for applications indicated by sealants manufacturer based on field experience and laboratory testing.

B. Backer Rods for Cold Applied Sealants: Performed, compressible, resilient, non-waxing, non-extruding strips of flexible, plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Closed cell polyethylene foam, nonabsorbent to liquid water and gas, and non-outgassing in un-ruptured state.

2. Proprietary, reticulated, closed-cell polymeric foam, non-outgassing, with a density of 2.5 pcf. and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gram/cubic centimeter per ASTM C 1083.

3. Either material indicated above.

1. Bond Breaker Type: Polyethylene tape of other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesions would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in pace at least 24 hours after concrete placement

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/2 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/2 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain maximum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and laces splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

B. Contraction joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

3. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Provide performed galvanized steel or plastic keyway-section forms or bulkhead forms with key, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.

2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

3. Provide tie bars at sides of paving strips where indicated.

4. Use bonding agent one existing concrete surfaces that will be joined with fresh concrete.

D. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 40 feet, unless indicated otherwise.

2. Extend joint filler full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

3. Furnish joint filler in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protection cap after concrete has been placed on both sides of joint.

E. Walks shall be constructed to match existing concrete at existing road tie-ins.

1. Expansion joints between building and pavement shall be cork.

2. Pavements shall be separated from curbs by a construction joint using felt roofing paper material.

3. “Zip Strip” control joint to be installed at a maximum of 24' and between existing walks and new concrete.

4. Saw cut control joints are not permitted.

5. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

3.5 JOINT SEALANT INSTALLATION

A. Clean out joints before installing joint sealants to comply with recommendations of manufacturer.

B. Comply with Joint Manufacturer printing installation instructions and recommendations of ASTM C 962 for use of joint sealants.

C. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to a smooth, uniform bead to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint.

1. Do not use tooling agent that discolor sealants or adjacent surface or are not approved by the sealant manufacturer.

2. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so they **are without deterioration at final acceptance.**

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete framework installation, reinforcing steel, and item to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove ice, snow, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements with ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.

F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidation concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agency if acceptable to Architect.

J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutter to required cross section, lines, grade, finish and

jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

K. Slip Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.

1. Compact subbase and prepared subgrade of sufficient width to prevent displacement of pave machine during operation.

L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

M. Cold Weather Placement: Comply with provision of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. Concrete placement shall begin only when the ambient air and surface temperature is at least 40° F and rising and discontinued anytime the temperature falls below 40° F. Placing concrete on a frozen base is prohibited.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agent or chemical accelerators unless otherwise accepted in mix designs.

N. Hot Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 70° F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to concrete is Contractor’s option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft sport, or dry areas.

3.7 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across concrete, perpendicular to line of traffic, to provide a uniform gritty texture finish.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

B. Final Tooling: Tool edges of paving, gutter, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 3/8 inch

3.8 CONCRETE PROTECTION AND CURING

A. General: Following texturing and edging, the concrete shall be cured for a minimum of 72 hours. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instruction after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture-Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and keep continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL TESTING

A. The Owner will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.

b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40° F and below and when 80° F and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. But less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operation and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test results falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design

compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

C. Nondestructive Testing: Impact hammer sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Architect when necessary, to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 321300

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Pavers
   2. Edge Restraints

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Pavers.
   2. Edge restraints.
   3. Sand for joints.

B. Samples for Initial Selection: For the following:
   1. Each type of unit paver indicated.
   2. Sand for joints for color selection.
   3. Exposed edge restraints involving color selection.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   2. Mockups shall be a minimum 5’x5’ panel with at least one side abutting approved edge restraint, curb, or wall.
   3. Provide a minimum 3-day notice to Architect for mockup approval.

C. Pre-installation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Retain first paragraph below if bituminous setting bed is used.

PART 2 - PRODUCTS (Basis of Design)

2.1 PAVERS

1. Concrete Unit Pavers (P-1) PlankStone® Paver. Hanover Architectural Products 5000 Hanover Road Hanover, Pennsylvania 17331. www.hanoverpavers.com (717) 637-0500.
   a. Face Size: 17 7/8” x 5 7/8”
   b. Thickness: 2”
   c. Color Matrix:
      a) 30% Natural; Tudor finish
      b) 40% Limestone; Tudor finish
      c) 30% Charcoal; Tudor finish
   d. Install on bituminous setting bed

2. Concrete Unit Pavers (P-3) Hexagonal Prest® Paver. Hanover Architectural Products 5000 Hanover Road Hanover, Pennsylvania 17331. www.hanoverpavers.com (717) 637-0500.
   a. Face Size: 15 7/8” across flats
   b. Thickness: 2”
   c. Color Matrix:
      a) 60% Natural; Tudor finish
      b) 40% Charcoal; Tudor finish
   d. Install on bituminous setting bed

2.2 EDGE RESTRAINTS

1. Aluminum Edge Restraint, where paver fields are not bordered by curb, wall, building, or other structural element: StructurEdge; Aluminum Brick and Paver Restraint. Permaloc 13505 Barry Street, Holland Michigan 49424 (616) 399-9660; www.permaloc.com
   a. Size: 3/16” X 2-1/4”
   b. Length: 8’-0” sections.
   c. Color: (MF) Mill Finish – Natural Aluminum
   d. Install per manufacturer’s “Installation Guidelines”; connection between sections to utilize manufacturer’s sliding connector system.

2.3 BITUMINOUS SETTING-BED MATERIALS

A. Primer for Base: ASTM D2028/D2028M, cutback asphalt, grade as recommended by unit paver manufacturer.

B. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.

1. Provide sand of color needed to produce light gray joint color.

2.4 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials per manufacturer’s standard, otherwise mix at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F (149 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use pavers with chips, cracks, voids, discolorations, or other visible defects.

B. pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut pavers as manufacturer identifies to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Locate cut units on at edges of paver fields. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Pattern: As indicated on plans.

E. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.

F. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving. All walking surfaces shall satisfy applicable ADA standards to provide an accessible route.

G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.

3.4 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 1400

SECTION 32 17 23 - PAVEMENT MARKINGS

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated January, 2008 and as amended.

E. SHA's "Maryland Manual on Uniform Traffic Control Devices for Streets and Highways", 2011 Edition and as amended.

1.2 SUMMARY

A. This Section includes the following:

1. Pavement-marking paint.

B. Related Sections:

1. Section 01 77 00: Closeout Procedures

2. Section 31 23 00: Excavating and Filling

3. Section 32 12 00: Flexible Paving

4. Section 32 13 00: Rigid Paving

1.3 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

1. Pavement-marking paint, acrylic.

2. Pavement-marking paint, latex.

3. Glass beads.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.

C. Qualification Data: For firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.4 QUALITY ASSURANCE

A. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore City Standard Specifications and Details, or other guidelines set forth by the authorities having jurisdiction the more stringent will apply.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated January, 2008 and as amended and the “City of Baltimore Department of Public Works Specifications for Materials, Highways, Bridges, Utilities, and Incidental Structures”, 2006 edition and as amended for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer’s labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Pavement-marking Paint: Apply pavement marking on clean, dry surfaces as specified at the manufacturer’s recommended ambient, surface and material temperatures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aexcel Inc.
2. Benjamin Moore & Co.
3. Color Wheel Paints & Coatings.
4. Columbia Paint & Coatings.
5. Conco Paints.
6. Coronado Paint; Division of INSL-X Products Corporation.
7. Diamond Vogel Paints.
8. Dunn-Edwards Corporation.
9. Ennis Traffic Safety Solutions, Inc.
10. Frazee Paint.
11. General Paint.
12. Kwal Paint.
13. M.A.B. Paints.
14. McCormick Paints.
15. Miller Paint.
16. Parker Paint Mfg. Co. Inc.
17. PPG Industries.
18. Pratt & Lambert.
19. Rodda Paint Co.
20. Rohm and Haas Company; a subsidiary of The Dow Chemical Company.
21. Scott Paint Company.
22. Sherwin-Williams Company (The).

2.2 PAVEMENT MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Colors: White, Yellow, Blue

B. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.

1. Colors: White, Yellow, Blue

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.

1. Colors: White, Yellow, Blue

D. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.

1. Colors: White, Yellow, Blue

E. Glass Beads: AASHTO M 247, Type 1 made of 100 percent recycled glass.

1. Roundness: Minimum 75 percent true spheres by weight

F. VOC Content: Pavement markings used on building interior shall have a VOC content of 150 g/l or less.

PART 3 EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to cure for 30 days before starting pavement marking.

C. Pavement surfaces shall be dried free of oil, dirt, grease, and other contaminants prior to application of pavement markings surfaces not in conformance shall be cleaned by the Contractor to a width of 4 to 6 inches wider than the markings to be applied.

D. Existing pavement markings that conflict with new or altered traffic pattern shall be completely removed by the Contractor. The method used by the Contractor for removal shall not damage the pavement surface and shall be approved by the Engineer. Any pavement damaged shall be repaired or replaced as determined by the Engineer at no additional cost to the Owner.

E. Apply paint with mechanical equipment to produce pavement marking of dimensions indicated with uniform, straight edges. Apply at manufacturer’s recommended rates to provide a minimum wet film thickness of 15 mils.

3.2 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during the remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

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SECTION 32 91 13 - SOIL PREPARATION

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated January, 2008 and as amended.

D. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration and the Owner for approval. Those judged to be equal to that specified will receive written approval unless otherwise noted within these specifications.

E. 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended.

1.2 SUMMARY

A. Section includes planting soils specified by composition of the mixes.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.

2. Section 321443 "Porous Unit Paving" for placing planting-soil fill in porous paving.

3. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.

4. Section 329300 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. Biochar: A fine-grained charcoal produced from low temperature pyrolysis (350 -450 °C) of plant and animal waste. Maximum 5% use in soil mixes. Meets IBI Biochar Standards.

D. CEC: Cation exchange capacity.

E. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

F. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

G. Imported Soil: Soil that is transported to Project site for use.

H. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

I. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

J. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

K. OMRI: Organic Materials Review Institute: A Nonprofit organization that provide independent review of products intended for use for organic production or processing.

L. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

M. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

O. SSSA: Soil Science Society of America.

P. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

Q. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

R. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

S. USCC: U.S. Composting Council.

T. Vermiculite: A hydrous A hydrous phyllocilicate material. Free Moisture Maximum: 0.5%, pH 7.0-7.6, Mesh size: 5 mesh to 5/16-inch coarse grade.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.

2. Include test data substantiating that products comply with requirements.

3. Include sieve analyses for aggregate materials.

4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.

b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.

c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

d. Lab analysis of Compost as provided by a Seal of Testing Assurance (STA) certified lab with analysis from within 90 days.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

C. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.

1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

C. Compaction or Percolation Testing: For a minimum of three different and distinct areas to receive planting perform testing on the subgrade to receive planting soil to confirm subbase soils are not overly compact or not sufficiently percolating by one of the following means:

1. Standard Proctor density according to ASTM D698: 75 to 82 percent of maximum

2. Water infiltration and Percolation: to be within 1 to 2 inch per hour.

1.9 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.

1. Number and Location of Samples: Minimum of three representative soil samples from varied locations on site for each soil to be used or amended for landscaping purposes.

2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."

3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.

b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."

3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.

4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

a. Arsenic, ppm max: 3.0

b. Lead, ppm max: 10

c. Selenium, % max.: 0.0030

d. Boron, ppm max.: 15

e. Chlorides (Cl), % max.: 0.06

f. Sodium Salts (Na), ppm max.: 25

g. Potassium Salts (K) ppm max.: 25

h. Calcium Salts (CA) ppm max.:25

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT SERA-6, including the following:

1. Percentage of organic matter.

2. Percent of humus

3. CEC, calcium percent of CEC, and magnesium percent of CEC.

4. Soil reaction (acidity/alkalinity pH value).

5. Buffered acidity or alkalinity.

6. Nitrogen ppm.

7. Phosphorous ppm.

8. Potassium ppm.

9. Manganese ppm.

10. Manganese-availability ppm.

11. Zinc ppm.

12. Zinc availability ppm.

13. Copper ppm.

14. Sodium ppm and sodium absorption ratio.

15. Soluble-salts ppm.

16. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.

17. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.

2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Do not move or handle materials when they are wet or frozen.

4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Regional Materials: Imported soil, manufactured planting soil and soil amendments and fertilizers shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Planting-Soil Type A: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil meeting USDA texture of a Sandy Loam or Loam

1. Additional Properties of On-Site Soil before Amending: Soil reaction of pH 5.8 to 7.5 and minimum of 2 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.

2. Unacceptable Properties: Clean soil of the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 3 inches in any dimension.

3. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Ratio of Loose Compost to Soil: 1:4 by volume.

b. Weight of Lime: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

c. Weight of Sulfur or Iron Sulfate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

d. Weight of Agricultural Gypsum: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

e. Weight of Superphosphate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

f. Weight of Slow-Release Organic Fertilizer: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

4. Planting Soil Depth:

a. 2-inch Depth on slopes 2:1 or greater

b. 4-inch depth on slope 2:1 to 3:1

c. 6” depth minimum on slopes less than 3:1

C. Planting-Soil Type B: Manufactured soil consisting of manufacturer's basic sandy loam or loam according to USDA textures, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.

1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.

2. Unacceptable Properties: Manufactured soil shall not contain the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner,

turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

3. Blend manufacturer's basic soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Ratio of Loose Compost to Soil: 1:4 by volume.

b. Weight of Lime: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

c. Weight of Sulfur or Iron Sulfate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

d. Weight of Agricultural Gypsum: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

e. Weight of Superphosphate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

f. Weight of Slow-Release Organic Fertilizer: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

4. Planting Soil Depth:

a. 2-inch depth on slopes 2:1 or greater

b. 4-inch depth on slope 2:1 to 3:1

c. 6” depth minimum on slopes less than 3:1

D. Planting-Soil Type C: Imported, naturally formed soil from off-site sources and consisting of loam soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.

2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.

3. Unacceptable Properties: Clean soil of the following:

   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

   b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

   c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2.5 inches in any dimension.

4. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

   a. Ratio of Loose Compost to Soil: 1:4 by volume.

   b. Weight of Lime: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

   c. Weight of Sulfur or Iron Sulfate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

   d. Weight of Agricultural Gypsum: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

   e. Weight of Superphosphate: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

   f. Weight of Slow-Release Organic Fertilizer: Based upon soil test recommendations per 1000 sq. ft. per 6 inches of soil depth.

5. Planting Soil Depth:

   a. 2-inch Depth on slopes 2:1 or greater

   b. 4-inch depth on slope 2:1 to 3:1

   c. 6” depth minimum on slopes less than 3:1

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.

2. Form: Provide lime in form of ground dolomitic limestone or calcitic limestone or mollusk shells.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: Limited to leaves.

2. Reaction: pH of 5.5 to 8.

3. Soluble-Salt Concentration: Less than 1 dS/m.

4. Moisture Content: 35 to 55 percent by weight.

5. Organic-Matter Content: 30 to 40 percent of dry weight.

6. Particle Size: Minimum of 98 percent passing through a 2-inch sieve.

B. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

C. Rice Hulls: Sized cleaned and heat-treated

D. Coffee Grinds: Coffee brewing by-product free of other waste materials

E. Tea Grinds: Tea brewing by-product free of other waste materials

F. Coconut coir: Coconut coir or husk fiber with a pH of 5.7 to 6.8, sustainably harvested, short fiber

2.5 FERTILIZERS

A. Organic fertilizers: Wet or Dry soil amendment derived from natural sources that indicates a minimum percentage of nitrogen phosphate and potash.

1. Products approved by the Organic Materials Review Institute shall be used for the appropriate crop or plant type.

2. Nutrient Composition for bidding purposes: 20 percent nitrogen, 0 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

3. Nutrient Composition for application purposes: Based upon soil test report recommendations for each plant type.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

B. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

C. Screening: Pass unamended soil through a 3-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended on-site soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth of 2 inches on 2:1 slopes or greater, 4” on slopes 2:1 to 3:1 and 6” on slopes less than 3:1, but not less than required to meet

finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

    a. Mix lime and sulfur as indicated by soil test recommendations with dry soil before mixing fertilizer.

    b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698 and tested in-place except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING IMPORTED OR MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply imported or manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Application: Spread planting soil to total depth of 2 inches on 2:1 slopes or greater, 4” on slopes 2:1 to 3:1 and 6” on slopes less than 3: 1, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place unamended soil to remain in place to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime and sulfur as indicated by soil test recommendations with dry soil before mixing fertilizer.

2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.

2. Water Infiltration or Percolation:

3. If the base soils do not meet the compaction or percolation rates the Contractor shall notify the Architect and provide recommendations to decompact the soils by one of the following:

a. Deep tillage or subsoiling to a depth of 24 to 36 inches

b. Shallow tillage: rototilling to break-up surface compaction

c. Plug aeration

d. Air tilling: Compressed air high pressure tool to loosen the soil

3. Decompaction shall be implemented in planting areas not meeting compaction or percolation requirements with the exception of:

a. Tree protection areas

b. Compaction zones for utilities

c. Pavements and structures

C. Soil will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Vehicle traffic.

4. Foot traffic.

5. Erection of sheds or structures.

6. Impoundment of water.

7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.8 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Sodding.
4. Turf renovation.
5. Grass paving.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network of the American Nursey and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the National Association of Landscape Professionals:

a. Landscape Industry Certified Technician - Exterior.
b. Landscape Industry Certified Lawn Care Manager.
c. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: March 30 – June 1.
2. Fall Planting: September 1 – October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
1. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 30 percent chewings red fescue (Festuca rubra variety).

c. 10 percent perennial ryegrass (Lolium perenne).
d. 10 percent redtop (Agrostis alba).

2. Shade: Proportioned by weight as follows:

a. 50 percent chewings red fescue (Festuca rubra variety).
b. 35 percent rough bluegrass (Poa trivialis).
c. 15 percent redtop (Agrostis alba).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

A. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
2. Sun and Partial Shade: Proportioned by weight as follows:

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 30 percent chewings red fescue (Festuca rubra variety).
c. 10 percent perennial ryegrass (Lolium perenne).
d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

a. 50 percent chewings red fescue (Festuca rubra variety).
b. 35 percent rough bluegrass (Poa trivialis).
c. 15 percent redtop (Agrostis alba).

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Based on the results of the soil tests and recommendations of the soil testing laboratory.

2. All fertilizers must comply with current Maryland Fertilizer Laws.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Hydroseeding Mulch: Mulch shall be composed of cellulose or wood fiber products with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the manufacturer specified proportions, will form homogeneous slurry which is capable of being sprayed to form a porous mat. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these specifications.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 GRASS-PAVING MATERIALS

A. Soil for Paving Fill: Refer to Section 32 9113 “Soil Preparation” for Fiber Soil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Place pre-blended planting soil over exposed subgrade.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h).

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 8 to 10 lbs/1000 sq. ft. (1.4 to 1.8 kg/92.9 sq. m) or as specified by supplier, whichever is greater.

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas from hot, dry weather or drying winds by applying specified mulch within 24 hours after completing seeding operations.

3.5 HYDROSEEDING

A. Hydroseeding: Mix and apply specified seed, fertilizer, and fiber mulch per manufactur.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen, muddy, or otherwise unsuitable.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.7 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

1. Soil Amendment(s): according to requirements of Section 329113 "Soil Preparation."
2. Initial Fertilizer: Slow-release fertilizer applied according to manufacturer's recommendations.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. 3-4 inches for all turf, seeded or sodded.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.11 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion plus a minimum of 3 mowings.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 30 days from date of planting completion plus a minimum of 3 mowings.

END OF SECTION 329200

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SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work Included: The Work of this Section includes, but is not limited to the following:

1. Trees.
2. Shrubs.
3. Ground cover.
4. Perennial plants.

1.3 REFERENCES

A. Standards: Comply with applicable recommendations of the following:

1. “Standardized Plant Names”, American Joint Committee on Horticultural Nomenclature.
2. American Standard for Nursery Stock”, American Association of Nurserymen (ANSI 260.1)
3. “Landscape Specifications Guidelines for Baltimore-Washington Metropolitan Areas”, latest edition.

B. Related Requirements:
1. Section 32 9113 "Soil Preparation" for providing and placing soil.

1.4 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.

C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

F. Finish Grade: Elevation of finished surface of planting soil.

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

H. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.5 SUBMITTALS

A. Comply with the requirements of Division 1 Section Submittals. Incomplete or improper submittals will be returned to the Contractor without change in contract time.

B. Samples for Verification: For each of the following:

1. Submit one pound samples, packaged in plastic bags, to the Landscape Architect for examination and approval prior to any landscape operations:

a. Mulches.
b. On-site soils.
c. Imported soils.
d. Organics.
e. Soil mixes.

C. Material Certificates: Submit the following manufacturer's information and source data:

a. Commercial fertilizers.
b. Chemical additives.
c. Organics.
d. Lime.
e. Iron Sulfate.
f. Filter Cloth/Soil Separator.
g. Erosion Control Fabric.

D. Qualification Data: For landscape installer.

E. Material Test Reports: For existing surface soil and imported topsoil.

F. Planting Schedule: Indicating anticipated planting dates for exterior plants.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Not less than 5 years documented successful experience in installation of work similar to Work in this Project.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Planting Soil Analysis: Furnish soil analysis per the requirements of Section 32 9113 Soil Preparation.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches aboveground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

H. Plant Substitutions – Pre-Bid:

1. Make every reasonable effort to find the plant material specified by the Architect.
2. Qualify bid to document any plant suitability or availability problems.
3. Offer substitutions to the Architect for consideration if there are legitimate availability problems.
4. Offer substitutions if there are known diseases or insect resistant species that can be substituted for a pest prone plant, if specified.
5. Submit a Base Bid as per plans and specifications, plus any price changes or clarifications for all recommended plant substitutions.

I. Plant Substitutions – Post-Bid, Pre Installation:

1. It is the intent to reduce or eliminate post-bid substitutions.
2. Substitutions of plant materials will not be permitted unless authorized in writing by Architect.
3. If proof is submitted that any plant accepted during the bidding process is not attainable, a proposal will be considered for use of nearest equivalent size or variety, with corresponding adjustment of Contract price if necessary.
4. These provisions do not relieve Contractor of responsibility for obtaining required materials in advance if special growing conditions or other arrangements can be made in order to provide the required materials.

J. Preliminary Plant Acceptance:

1. Architect or his representative may view plants at their place of growth or upon delivery. Architect reserves the right to tag plants at their place of growth.
2. For distant material, photographs may be submitted in lieu of on-site inspections or for preliminary reviews prior to on-site inspection.
3. Send Architect written request for plant inspection at their place of growth at least ten calendar days prior to digging.
4. Identify place of growth and quantity of plants to be inspected.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

1. Immediately after digging up bare-root stock, pack root system in wet straw, or other suitable material to keep root system moist until planting.

B. Do not prune trees and shrubs before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Plants damaged in transit, storage or handling may be rejected at the sole discretion of the Architect. Consideration for plant material damage may not be life threatening, but rather cosmetic such as broken branches or scratched trunks, to qualify plant for rejection.

E. Root balls which are not tight and properly prepared or show signs of damage will be rejected.

F. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container grown stock from containers before time of planting.

4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
5. If plant material is stored more than three days on site, return it to the nursery for proper care until it can be planted.

1.8 PLANT SEASONS

A. B&B, deciduous trees and shrub materials:

1. Lowest Risk: March 1 to May 30 and September 15 to December 1.

a. Deciduous plants dug and planted while dormant in spring or fall except those listed below.
b. Deciduous plants dug during dormancy and planted after producing leaves providing they have been properly stored.
c. Deciduous plants dug after leaves have fully expanded and harden off.

2. Highest Risk:

a. Deciduous plants dug in the spring during newly expanding leaf production.

B. Evergreen B&B material:

1. Freshly dug evergreen material should not be moved without proper conditioning during active growth.

C. Summer dug B&B material shall be handled in one of the following methods in order to harden off:

1. Properly hardened-off in field 7-10 days prior to digging by a gradual process of trenching and soaking, leaving the bottom surface of the ball attached to soil until shipping.
2. Condition under irrigation in partial shade for at least 4 days prior to shipping.

D. Perennials:

1. May be installed as soon as the ground is workable in Spring after March 1 until November 15.
2. Any plants required to be installed after November 15, will require protective, supplemental mulching applied after December 15 and removed when weather permits around March 1.

E. Annuals:

1. Cold sensitive annuals may be installed after danger of frost has passed and as soon as the ground is workable in the Spring after March 1 and November 15.

F. Spring Flowering Bulbs:

1. May be installed between September 15 to December 31.

G. Excluded Material:

1. The following trees may not be installed between November 15 and March 1: White oak (Quercus alba), Scarlet Oak (Quercus coccinea), Red Oak (Quercus rubra), Willow Oak (Quercus phellos), Flowering Dogwood Varieties (Cornus florida), Sweet Gum (Liquidambar styraciflua) and all conifers with the exception of White Pines (Pinus strobus).

H. Out of season plant installation:

1. A professional horticulturist, nurseryman or arborist shall be consulted to determine the proper time, based on plant species and weather conditions, to move and install particular plant material to minimize plant stress if it is required to move material outside of the preceding guidelines.
2. Should plant material be required to be installed for the contractor's convenience, it shall be at the Contractor's full risk and responsibility. However, if plants are required to be installed as per the owner's direction, plant warranty may be waived.
3. Architect will only allow variance in planting season upon written request.

1.9 WARRANTY

A. Warrant that all trees, shrubs, vines, groundcovers, perennials, and bulbs planted under this Contract will be healthy and in flourishing condition of active growth for a period of 12 Months from date of completion and initial acceptance of the work.

B. Any delay in completion of planting operations which extends the planting into more than one planting season shall extend the Warranty period correspondingly.

C. Provide written warranty certificates to the Architect.

D. Warranty Provisions:

1. Remove plants that are in the opinion of the Architect, at least 25% dead, unsightly, or not in healthy condition.
2. Replace removed plants and plants missing due to Contractor's negligence. Replace when weather conditions permit and within specified planting period, or as directed by Landscape Architect.
3. Provide replacement plants closely matching adjacent specimens of same species.
4. Warrant replacement plants for additional period of one year from date of their acceptance after replacement. Note that failure to replace plants in a timely and responsive manner may result in reduction and/or forfeiture of final payments.

1.10 MAINTENANCE

A. Begin maintenance immediately after plants are installed and continue to maintain for a period of two years. The two-year period begins after approved substantial completion by the Landscape Architect. At the end of the two-year maintenance period a final site walk will be scheduled with the Landscape Architect and representatives of the University and upon acceptance the site will be turned over to the University to their maintenance crews.

B. Maintenance Requirements:

1. Protects plants and planting areas from damage.
2. Keep plants healthy, vigorous, trim and neat.
3. Prune to maintain plants in normal growth pattern.
4. Spray to control disease and insects.
5. Maintain mulch bed to 2 inch depth. Re-mulching of the plant materials is not required as part of the work.
6. Keep beds free of weeds.
7. Provide manpower in order to water all plant materials as required to maintain adequate moisture, and when directed by Architect.
8. Maintain stakes and guys in taut and rigid state with wires in place and safety flags clearly visible. Remove stakes and guys when no longer necessary for plant establishment after one year.
9. Reset plants to proper grade and upright condition if required and add topsoil and mulch to areas of settlement.
10. Provide additional stakes as required to support trees particularly evergreens in areas prone to high winds or settlement.
11. Provide maintenance schedule/ program for UMBC approval at the initial acceptance of the work.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

2.2 PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

C. Fast-Growing Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1. Two-year plants with heavy, well-branched tops, with not less than 3 runners 18 inches or more in length, and with a vigorous well-developed root system.
2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable

2.3 TOP SOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Coordinate requirements for manufactured and imported soil with Section 32 9113 Soil Preparation.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
2. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.

C. Aluminum Sulfate: Commercial grade, unadulterated.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: ground, containing a minimum of 90 percent calcium sulfate.

F. Sand: Clean, washed natural or manufactured, free of toxic materials.

G. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 ORGANIC SOIL AMENDMENTS

A. Composted Leaves such as Leaf Gro

2.6 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.

2.7 MULCHES

A. A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood, mulching grade, uniform in size, and free from foreign matter, or approved unscreened biosolid compost.

2.8 STAKE AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.

C. Guy Cable: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.

D. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.9 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

2.10 PLANTING SOIL MIX

A. Planting Soil Mix: Provide manufactured soil per the Soil Preparation Section 32 9113.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Contact ‘MISS UTILITY’ at 800-257-7777 (72) hours prior to digging. Contractor shall take sole responsibility for any cost incurred due to damage due to these utilities.

C. Do not willfully proceed with planting as designed when it is obvious that conditions and/or obstructions exist due to changes in site conditions. Such conditions shall be brought to the immediate attention of the Landscape Architect. The Contractor will be held responsible for all necessary revisions due to failure to give such notification so that material can be relocated or conditions corrected prior to plant installations.

D. Remove any existing plant material necessary for the installation and the completion of the planting designed and contracted as part of this project.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter.

1. Apply superphosphate fertilizer directly to subgrade before loosening only if indicated by soil testing.
2. Spread planting soil, apply leaf gro and fertilizer on surface, and thoroughly blend planting soil mix.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil as indicated in Section 32 9113 Soil Preparation.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.

B. Subsoil removed from excavations may not be used as backfill.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

3.5 SOIL DRAINAGE TEST

A. Before planting, determine that areas to receive plant material have adequate sub-drainage. Contractor is responsible for correcting all drainage conditions which may adversely impact the establishment of specified plantings.

1. Perform water percolation tests for the following areas or as required in low areas where soils may not adequately drain.
2. Test by digging tree and shrub pits to the full depth and dimensions indicated on drawings.
3. Fill excavations to 1/3 depth with water and allow to percolate out before planting.
4. If after 24 hours, water remains in excavation, perform a more detailed percolation test as described below and notify Architect in writing.
5. At bottom of planting pit, excavate rectangular pit 12 inches x 12 inches x 18 inches deep. Pour water into this small pit to a depth of 6 inches (approximately 3 – 3 ¾ gallon). Note time required for water to be completely absorbed. Divide time noted by 6, to achieve average rate of absorption for 1 inch of water.

3.6 SOIL DRAINAGE IMPROVEMENTS

A. Where slope conditions permit, areas that do not drain properly may be drained to daylight with Architect's approval.

1. Use 3" diameter slotted corrugated polyethylene non-perforated drainage tubing per ASTM F-405 within tree pit or bed areas. Provide non-slotted type beyond plant pits or plant bed areas.
2. Minimum slope on drainage tubing shall not be less than 2%.

B. In areas that are low along streets and do not drain due to hydrostatic pressure, drainage improvements may require the following:

1. Excavate the bottom of the plant pit or bed so that the unexcavated portion slopes towards the low side of the pit or bed area.
2. Install drainage sack comprised of 3" diameter slotted corrugated polyethylene nonperforated drainage tubing per ASTM F-405, inside 8" ¾" washed gravel, wrapped in geotextile filter fabric such as Mirafi 140 S or N by Mirafi Inc., or approved equal.
3. Minimum slope on drainage tubing shall not be less than 2%.
4. Provide a vertical standpipe at each tree pit.
5. Connect slotted corrugated polyethylene non-perforated drainage tubing to nearby drain inlet where inverts permit.

3.7 TREE AND SHRUB PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball one inch above adjacent finish grades.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

B. Set balled and potted container-grown stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.

1. Carefully remove root ball from container without damaging root ball or plant.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Organic Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.

3.8 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.9 GUYING AND STAKING

A. A. Upright Staking and Tying: Stake trees of 2-inch through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Support trees with two strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Use the number of stakes as follows:

1. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
2. Attach flags to each guy wire, 30 inches above finish grade.
3. Paint turnbuckles with luminescent white paint.

3.10 GROUND COVER AND PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated.

1. Organic Mulch: Apply 3-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.12 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.13 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property

3.14 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 24 months from date of Substantial Completion.

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 24 months from date of Substantial Completion.

END OF SECTION 329300

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SECTION 331000 - WATER UTILITIES

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes water systems piping for potable water service and fire protection service outside the building.

B. Related Specifications: The following standard specifications are made a part of this specification to the extent referenced herein.

1. National Fire Protection Association "Standard for Installation of Private Fire Supply Mains and Their Appurtenances - NFPA 24."

C. Related Sections:

1. Section 312300: Excavating, Filling& Grading.

2. Refer to sections relating to fire protections systems and water distribution systems in Division 22.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Pressure Rating: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.

1. Underground Piping: 280 psig with an actual operating pressure of 125 psig.

2. All materials shall be in accordance with the requirements of the Baltimore City Plumbing Code and the Baltimore City Department of Public Works.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division I Specification Sections.

B. Product data for the following:

1. Identification materials and devices.

C. Coordination drawings showing pipe sizes and elevations. Include details for connections, anchors, and reaction backing. Show other piping in same trench and clearances from water system piping. Indicate interface and spatial relationship between piping and proximate structures.

D. Record drawings at Project closeout of installed water system piping and products according to Division 1 Section “Project Closeout”.

E. Test reports specified in “Field Quality Control” Article in Part 3.

1.5 QUALITY ASSURANCE

A. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.

B. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing, and disinfection.

C. Comply with NFPA 24 “Standards for the Installation of Private Fire Service Mains and Their Appurtenances” for materials, installations, tests and flushing.

D. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1. The Terms “Listed and Labeled”: As defined in “National Electrical Code,” Article 100.

2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

E. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and model indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Architect. The burden of proof of equality of products is on Contractor. Refer to Division 1 Section “Product Substitutions.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling, to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation repots was used for the basis of the design. The data in the subsurface investigation report is not a part of the Contract. Conditions are not intended as representations or warranties of accuracy or continuity between soil bores. The Owner, Architect or Engineer will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

1. Additional test bores and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided. If existing utilities are indicated to be abandoned, the Contractor shall remove such utility, if necessary, at no additional cost to the Owner.

1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.

C. Should uncharted or incorrectly charted, piping, or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Open trench excavations within the limits of the State right-of-way shall be protected in accordance with the requirements of applicable permits. Open excavation within other roadways shall be plated and shall be posted with warning devices in accordance with the Maryland Manual on Uniform Traffic Control Devices.

1. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

2. Work which affects the public right-of-way shall be in accordance with the Baltimore City Department of Public Works requirements and regulations.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building fire protection systems piping.

B. Coordinate with pipe materials, sizes, and entry locations, and pressure requirements of building water distribution systems piping.

C. Coordinate with other utility work.

D. Coordinate electrical requirements of actual equipment furnished with requirements specified in Division 26.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with the requirements of Baltimore City, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Drilling Machine Corporation Stops:

a. Ford Meter Box Co., Inc.

b. Hays Div., Romac Industries

c. Mueller Co., Grinnell Corp.

2. Bronze Corporation Stops and Valves:

a. Ford Meter Box Co., Inc.

b. Hays Div., Romac Industries

c. A.Y. McDonald Mfg. Co.

d. Mueller Co., Grinnell Corp.

3. Tapping Valves:

a. A.P. Smith Manufacturing Company

b. M & H Valve & Fittings Company

4. Gate Valves:

a. A.P. Smith Manufacturing Company

b. M & H Valve & Fittings Company

5. Dry-Barrel Fire Hydrants:

a. American Darling Valve Company Model B-62-B

b. Dresser Manufacturing Company Reliant Style 929

c. Kennedy Valve Company Guardian Model K-81

e. Mueller Co. A-463 Centurian

f. U.S. Pipe & Foundry Co. Smith Model H 205

6. Drains:
    a. Ancon, Inc.
    b. Jones Manufacturing Co., Inc.
    c. Josam Co.
    d. Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
    e. Wade Div., Tyler Pipe Subsid., Tyler Corp.
    f. Zurn Hydromechanics Div., Zurn Industries, Inc.
7. Detector Check Valves:
    a. Ames Co., Inc.
    b. Hersey Products, Inc., Grinnell Corp.
    c. Kennedy Valve Div., McWane, Inc.
    d. Viking Corp.
    e. Watts Regulator Co.
8. Backflow Preventers:
    a. Ames Co., Inc.
    b. Cla-Val Co. Div., Griswold Industries
    c. Conbraco Industries, Inc.
    d. Febco.
    e. Hersey Products, Inc., Grinnell Corp.
    f. Watts Regulator Co.
    g. Wilkins Regulator Div., Zurn Industries, Inc.

2.2 PIPES AND TUBES

A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube materials specified below are used.

B. Ductile-Iron Pipe: AWWA C151, Classes 150, 200 and 250.
1. Lining: AWWA C104, cement mortar, seal coated.
2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.

3. Mechanical-Joint-Type Pipe: AWWA C111, rubber gaskets, ductile retain- or glands, and steel bolts and nuts.

4. Encasement: AWWA C105, polyethylene film tube.

C. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), seamless water tube, annealed temper.

D. Polyvinyl Chloride (PVC) Pipe: AWWA C900; Classes 150 and 200; with bell end and elastomeric gasket, with plain end for cast-iron or ductile-iron fittings, or with plain end for PVC elastomeric gasket fittings.

1. Pipe Marking: NSF 14, “NSF-pvc cto only.”

2. Gaskets: ASTM F 477, elastomeric seal.

2.3 PIPE AND TUBE FITTINGS

A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube fitting materials specified below are used.

B. Ductile-Iron Pipe Fittings Class D or Class 250: AWWA C110, ductile-iron, 250-psig (1725-kPa) minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psig (2400-kPa) pressure rating.

1. Lining: AWWA C104, cement mortar.

2. Gaskets: AWWA C111, rubber.

3. Polyethylene Encasement: AWWA C105, 8-mils. (2 mm) minimum thickness, tube or sheet.

C. Polyvinyl Chloride (PVC) Pipe Couplings and Fittings: AWWA C900, with ASTM F 477 elastomeric seal gaskets.

2.4 JOINING MATERIALS

A. Refer to Part 3 Article "Piping Applications" for identification of systems where joining materials specified below are used.

B. Ductile-Iron Pipe and Ductile-Iron Fittings: The following materials apply:

1. Mechanical Joints: AWWA C111 ductile-iron retainer glands, high-strength steel bolts and nuts, and rubber gaskets.

2.5 PIPING SPECIALTIES

A. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150-psig (1035-kPa) or 300-psig (2070-kPa) minimum pressure to suit system pressures.

B. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150-psig (1035-kPa) or 300-psig (2070-kPa) minimum working pressure to suit system pressures.

2.6 VALVES

A. Valves shall be in accordance with the latest requirements of Baltimore City and Baltimore City.

B. Valve Boxes: Concrete Sectional Vaults having frame and cover with lettering "Water Valve," in accordance with Baltimore City standards.

C. Tapping Sleeve and Tapping Valve: Shall be in accordance with the latest requirements of Baltimore City.

D. Service Clamps and Corporation Stops: Complete assembly, including service clamp, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.

1. Service Clamp: Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.

2. Corporation Stops: Bronze body and ground key plug, with AWWA C800 threaded inlet and outlet matching service piping material.

3. Manifold: Copper with 2 to 4 inlets as required, with ends matching corporation stops and outlet matching service piping.

2.7 WATER METERS

A. General: Provide water meter with registration in gallons.

B. Domestic Water Meter: As approved by Baltimore City.

C. Fire Service Water Meter: As approved by Baltimore City.

2.8 PITS

A. Concrete: Portland cement mix, 3000 psi (20.7 MPa).

1. Cement: ASTM C 150, Type I.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Reinforcement: Steel conforming to the following:

1. Fabric: ASTM A 185, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615, Grade 400), deformed.

3. Ladder: ASTM A 36 (ASTM A 36M), steel or polyethylene-encased steel steps.

4. Manhole: ASTM A 48, Class 35, gray-iron, 24-inch (610-mm) minimum diameter traffic frame and cover, of size and weight indicated.

5. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch (610-mm) minimum diameter traffic frame and cover, of size and weight indicated.

6. Drain: ASME A112.21.1M, cast-iron area drain, of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.9 FIRE HYDRANTS

A. General: “Traffic Model”, cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch (DN 150) mechanical joint inlet, 150-psig (1035-kPa) working pressure.

B. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

C. Operating and Cap Nuts: Pentagon 1-3/8 inch (3.5 cm) point to flat.

D. Direction of Opening: Open hydrant valve by turning operating nut to the left, or counterclockwise. Show direction of the opening on the bonnet with a raised arrow.

E. Finish: Sherwin Williams, Kem L-F65, E-36, Safety Orange Lead Free Industrial Enamel or approved equal.

F. Dry-Barrel Fire Hydrants: UL 246, FM-approved, two 2-1/2 inch (6.35 cm) and one 4-1/2 inch (11.4 cm) outlets, 5-inch (12.7 cm) min. main valve, drain valve, and 6-inch mechanical joint inlet and a flanged connection on the stand pipe end.

2.10 ANCHORAGES AND BUTTRESSES

A. General: All anchorages and buttresses shall be in conformance with the Baltimore City Specifications and Standard Details.

B. Concrete Reaction Backing: Portland cement mix, 3000 psi.

1. Cement: ASTM C 150, Type I.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable

2.11 IDENTIFICATION

A. Metallic-Lined Plastic Underground Warning Tapes: polyethylene plastic tape with metallic core, 6 inches wide, by 4 mils thick, solid blue in color with continuously printed caption in black letters “CAUTION - WATER LINE BURIED BELOW”.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section 312300.

3.2 SERVICE ENTRANCE PIPING

A. Extend water system piping from the existing public main to a point within 5' of the proposed building.

1. Terminate water system piping from the proposed public main to a point within 5' of the proposed buildings for fire protection.

B. Water distribution systems and fire protection systems are specified in Division 15 Sections. Sleeves and mechanical sleeve seals are specified in Division 15 Section “Basic Mechanical Materials and Methods.”

3.3 PIPING APPLICATIONS

A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping in pits and inside building may be joined with flanges or couplings, instead of joints indicated, for grooved-end AWWA-size piping.

B. Use pipe, tube, fittings, and joining methods according to following applications:

1. 4 inches (DN 100) to 8 inches (DN 200): Class D or Class 250, ductile-iron pipe, ductile-iron compact fittings, and mechanical joints with retainer glands.

3.4 JOINT CONSTRUCTION

A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.

B. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.

C. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to valve ends into which pipes are being threaded.

D. Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure. Refer to “Piping Systems - Common Requirements” Article for joining piping of dissimilar metals.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS:

A. Installation: Installation shall be in accordance with the Baltimore City Specifications; NFPA 24; the Baltimore City Plumbing Code; and the written recommendations of the pipe manufacturer, except that in the case where there are conflicts among the provision of the various installation requirements, the more stringent or restrictive requirements shall govern.

B. General Locations and Arrangements: Drawings indicate general locations and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.

C. Install components having pressure rating equal to or greater than system rated pressure (200 psig).

D. Install piping free of sags and bends.

E. Install fittings for changes in direction.

F. Piping Connections: Except as otherwise indicated, making piping connections as specified below.

1. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

2. Install dielectric fittings to connect piping of dissimilar metals.

3.6 PIPING INSTALLATION

A. Comply with requirements of NFPA 24 for materials and installation.

1. Bury piping at minimum depth of 48 inches below finished grade, and not less than 18 inches below average local frost depth.

3.7 ANCHORAGE INSTALLATION

A. Anchorages: Install anchorages for tees, plugs/caps, and bends. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron Piping: According to AWWA C600.

B. Apply full coat of asphalt or other acceptable corrosion retarding to surfaces of installed ferrous anchorage devices.

C. Anchorage blocks shall be constructed of a poured reinforced concrete pad, which partially encapsulates the fitting and prevents any relative movement between the straight section of the fitting and the branch section.

3.8 IDENTIFICATION INSTALLATION

A. Install continuous plastic underground warning tape during back filling of trench for underground water service piping. Locate 6 inches to 8 inches below finished grade, directly over piping.

3.9 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 2 times operating pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 1000 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

3.10 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.

2. Use purging and disinfecting procedures prescribed by Baltimore City Specifications and NFPA.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION 331000

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SECTION 333000 - SANITARY SEWERAGE UTILITIES

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes sewage disposal systems.

B. Related Sections:

1. Section 312300; Excavating, Filling & Grading.

2. Section 033310; Cast-In-Place Site Concrete.

3. Refer to sections relating to plumbing piping and drainage and vent systems in Division 22.

1.3 DEFINITIONS

A. Wastewater: Sewage, water or other liquid requiring disposal.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Solid Piping Rating: At least equal to system operating pressure.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Shop drawings for the following precast, reinforced concrete structures, including manhole openings, covers, pipe connections, and accessories.

C. Coordination drawings showing piping, underground structures, and other utilities. Indicate size and invert elevations of piping and structures.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the local health department and authorities having jurisdiction.

B. Product Options: Drawings indicate sizes, profiles, connections and dimensional requirements of septic system components. Manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Product Substitutions."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe or fittings in direct sunlight.

B. Protect pipe, pipefittings, and seals from dirt and damage.

C. Handle pre-cast concrete structures according to manufacturer's rigging instructions.

1.8 PROJECT CONDITIONS

A. Site Information Data in subsurface investigation reports was used for the basis of the design. The data in the subsurface investigation report is not a part of the Contract. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner, Architect or Engineers will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

1. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided. If existing utilities are indicated to be abandoned, the Contractor shall remove such utility, if necessary, at no additional cost to the Owner.

1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.

PART 2 PRODUCTS

2.1 PIPES AND FITTINGS

A. Refer to Part 3 "Piping Applications" Article for identification of systems where piping materials specified below are used.

B. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, nonperforated, for solvent-cement or elastomeric gasket joints.

1. Solvent Cement: ASTM D 2564.

2. Gaskets: ASTM F 477, elastomeric seal.

C. Ductile Iron Pipe and Fittings

1. Pipe – Class 50 Ductile Iron Pipe. Pipe nominal length may be 16 through 20 feet. All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden as indicated on the profile and traffic loads to which the pipe may be subjected. Ductile iron pipe and ductile iron and cast-iron fittings shall be cement-lined in accordance with AWWA C 104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surfaces shall be bituminous coated.

2. Joints – Joints may be mechanical or rubber gasketed push-on type. Unless otherwise noted, all joints shall be in accordance with AWWA C111.

3. Fittings – All fittings shall be manufactured in accordance with AWWA C110 or AWWA C153 for compact fittings sizes 3 inch through 16 inch. Fittings shall be designed and constructed to withstand a pressure not less than that for the adjacent pipe.

4. Lining and Coating – All pipe and fittings shall be cement-lined in accordance with AWWA C104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surface shall be bituminous coated.

D. High-Density Polyethylene

1. Pipe – DR 26 manufactured in accordance with AWWA C906 and ASTM F714.

2. Joints – Pipes shall be joined in accordance with manufacturer's recommendations.

E. Sleeve-Type Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

1. Sleeves for Plastic Pipe: ASTM F 477, elastomeric seal.

2. Bands: Stainless steel, at least one at each pipe insert.

F. Gasket-Type Couplings: Rubber or elastomeric compression gasket, made to match outside diameter of smaller pipe and inside diameter or hub or adjoining larger pipe.

1. Gaskets for Plastic Pipe: ASTM F 477, elastomeric seal.

2. Gaskets for Dissimilar Pipes: Compatible with pipe materials being joined.

2.2 CLEANOUTS

A. Description: ASME A112.36.2M, with round, flanged, cast-iron housing, and secured scoriated, medium-dry loading class, cast-iron cover. Include cast-iron ferrule and countersunk brass cleanout plug.

2.3 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast reinforce concrete, of depth indicated, with provision for rubber gasket joints, and frame and cover; all in accordance with Baltimore City Standard Details. A factory or field applied protective shall be applied in accordance with Baltimore City Standard Details and Specifications. Include indented top design with lettering, equivalent to the following cast into cover:

1. Sanitary Sewer Piping Systems: Sanitary Sewer

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section 312300 – “Excavating and Filling.”

3.2 IDENTIFICATION

A. Identification materials and their installation are specified in Division 31 Section “Excavating and Filling.” Arrange for installation of green warning tapes directly over piping (including absorption field piping), at outside edges of underground structures, and at outside edges of seepage pits.

1. Use detectable warning tape over edges of underground structures, edges of seepage pits, and over nonferrous piping.

3.3 GENERAL INSTALLATION

A. Installation: Installation shall be in accordance with the requirements of the Baltimore City Specifications, and in accordance with the Drawings.

B. Where installation details are not shown on the Drawings, installation shall be in accordance with the Baltimore City Standard Details.

C. Termination: Terminate piping 5' from building foundation in location as indicated. Provide temporary pipe plug for piping extension into building by work of Division 22.

3.4 PIPING APPLICATIONS

A. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below.

B. Use pipe, tube, fittings, and joining methods according to the following applications.

1. Solid Piping: Polyvinyl Chloride (PVC), non-perforated sewer pipe and fittings and solvent-cemented or gasketed joints.

3.5 PIPE JOINT CONSTRUCTION AND INSTALLATION

A Join and install polyvinyl chloride (PVC) pipe as follows:

1. Join solvent-cement type pipe and fitting with solvent cement according to ASTM D 2855 and ASTM F402.

2. Join gasketed pipe and fittings with elastomeric seals according to ASTM D 3212.

3. Install solid piping according to ASTM D 2321.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and extension for mapping to cleanout at grade as indicated. Set cleanout housing and cover in concrete block 18 by 18 by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade, or flush with grade when installed in paving.

B. Cleanouts installed in paving shall have countersunk lid.

C. Refer to Division 3 Section “Cast-in-Place Concrete” for formwork, reinforcing and concrete.

3.7 CONNECTIONS

A. Install standard manhole over existing sanitary sewer and connect proposed sanitary.

3.8 FIELD QUALITY CONTROL

A. System Tests: After installation, pipe shall be inspected visually for deflections and misaligned pipe sections.

1. All sewers shall be tested in accordance with Section 1007 of the Baltimore City Specifications, except that Contractor shall supply all materials needed for testing.

2. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repair until there is no leakage.

3. Cleaning: Clear interior of piping and structures of dirt and other superfluous materials as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

END OF SECTION 333000

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SECTION 334000 - STORM DRAINAGE UTILITIES

1.1 RELATED DOCUMENTS

A. Requirements of the General Provisions apply to all work under this section.

B. Baltimore City Department of Public Works Standard Details for Construction dated March 2008 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. This Section includes drainage systems five feet (5') outside the building. Systems include the following:

1. Storm drainage

2. Stormwater Management Facilities

B. Related Sections:

1. Section 312300; Excavating, Filling & Grading.

2. Refer to sections relating to plumbing piping, drainage and vent systems and laboratory systems in Division 22.

1.3 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.4 PERFORMANCE REQUIREMENTS:

A. Gravity-Flow, Non-pressure-Piping Pressure Ratings: At least equal to system test pressure.

B. Stormwater Management Permit: Stormwater management facilities shall be constructed in accordance with the approved drawings and the provisions of the Stormwater Management Permit. The Owner will obtain the Stormwater Management Permit prior to construction of the facility.

C. Certification of Completed Facilities: As-Built Plans and Certifications are required for the stormwater management facilities. In order to properly prepare these documents, this stormwater management facility must be inspected by a Registered Professional

Engineer at specific stages of the construction. The Contractor shall notify the Owner's Testing and Inspection Engineer at least five (5) working days prior to starting work on this stormwater management facility. **The Contractor shall provide an As-Built survey of all of the stormwater management facilities, signed and sealed by a Maryland Registered Surveyor. Preparation and processing of the As-Built Plans and Certification will be the responsibility of the Owner.**

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product indicated.

C. Product Certificates: For each type of pipe and fitting, from the manufacturer.

D. Shop drawings for precast concrete manholes and other structures. Include frames, covers and grates.

E. Shop drawings for the various types of piping.

F. Shop drawings for cast-in-place concrete or field-erected masonry manholes and other structures. Include frames, covers and grates.

G. Reports and calculations for design mixes for each class of cast-in-place concrete.

H. Inspection and test reports specified in the, "Field Quality Control," Article.

1.6 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.

B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.

C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Product Substitutions."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures in direct sunlight.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, pipefittings, and seals from dirt and damage.

D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

E. Stone to be delivered and placed immediately in the water quality facility and protected from soil contamination.

1.8 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design. The data in the subsurface investigation report is not a part of the Contract. Conditions are not intended as presentations or warranties of accuracy or continuity between soil borings. The Owner, Architect or Engineers will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

1. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Architect's written permission.

D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate with interior building drainage systems.

B. Coordinate with other utility work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleanouts

a. Ancon, Inc.

b. Jones Manufacturing Co., Inc.

c. Josam Co.

d. Rockford Sanitary Systems, Inc.

e. Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.

f. Wade Div., Tyler Corp.

g. Zurn Industries, Inc., Hydromechanics Div.

h. ACO Polymer Products, Inc.

2.2 PIPES AND FITTINGS

A. High Density Polyethylene (HDPE) Pipe and Fittings Hancor Blue Seal Water Tight: As manufactured by Advanced Drainage Systems, Inc. or approved equal.

B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B, for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

C. Polyvinylchloride (PVC): Schedule 40, watertight joints.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for Non-pressure joints.

1. Sleeves for Concrete Pipe: ASTM C 443 (ASTM C 443M), rubber.

2. Sleeves for Plastic Pipe: ASTM F 477, elastomeric seal.

3. Sleeves for Dissimilar Pipes: Compatible with pipe materials being joined.

4. Bands: Stainless steel, at least one at each pipe insert.

2.4 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints, and frame and cover, all in accordance with Baltimore City Standard Details. Cast iron frame and cover shall be minimum H20 loading. Include indented top design with lettering, equivalent to the following, cast into cover:

1. Storm Drainage Piping Systems: “STORM DRAIN.”

2.5 STORM DRAIN INLETS

A. General: Pre-cast reinforced concrete, or cast-in-place concrete complete with frames and grates, all in accordance with Baltimore City Standard Details unless otherwise noted on the contract drawings. Cast iron frame and grate shall be minimum H20 loading.

2.6 TRENCH DRAINS

A. General: Pre-cast reinforced concrete, polyester resin polymer concrete or cast-in-place concrete surrounding channel. All grates shall be ADA compliant and heel-proof. Grates shall be cast iron and have locking mechanisms. Grates shall be H20 loading where specified.

B. Polyester Resin Polymer Concrete shall conform to the following:

1. Compressive Strength: 14,000 psi
2. Flexural Strength: 4,000 psi
3. Tensile Strength: 1,500 psi
4. Water Absorption: 0.07%
5. Frost Proof: Yes
6. Dilute Acid and Alkali Resistant: Yes
7. B117 Salt Spray Test Compliant: Yes

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or held formed from concrete. Portland-cement design mix, 4000-psi minimum, with 0.45 maximum water-cement ratio. formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.

1. Invert Slope: 2.5 percent (1:40) minimum through manhole.

2. Manhole Benches: Concrete, sloped to drain into channel.

    a. Slope: 1 inch per foot (1:12) minimum.

3. Storm Drain Inlet Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.

    a. Invert Slope: 2.5 percent (1:40) minimum through inlet.

4. Storm Drain Inlet Benches: Concrete, sloped to drain into channel.

    a. Slope: 1 inch per foot (1:12) minimum.

    b. Ballast and Pipe Supports: Portland-cement design mix, 3000-psi minimum, with 0.58 maximum water-cement ratio.

5. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

6. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

2.8 PROTECTIVE COATINGS

A. General: Include factory - or field-applied protective coatings to structures and appurtenances according to the following:

B. Coating: Apply 2-coats, coal-tar epoxy, 15-mil minimum thickness, except where otherwise indicated.

1. Manholes: On exterior surfaces.

2. Storm Drain Inlets: On exterior surfaces.

2.9 CLEANOUTS

A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and found, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass, foot-traffic areas.

2. Medium Duty: In paved, foot-traffic areas.

3. Heavy Duty: In vehicle-traffic service areas.

B. Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings.

C. Cleanouts located in paved areas shall have countersunk lids.

2.10 RIPRAP

A. Stone for riprap shall be uniformly graded from the smallest to the largest pieces as specified in the Contract Documents. The stone will be accepted upon visual inspection at the point of usage, and shall conform to the following:

CLASS OF RIPRAP	WEIGHT RANGES lb. (kg)	APPROX. SIZE in. (mm)
0	1-33 (0.5 – 15)	2-7 (50-175)
I	2-150 (1-70)	3-12 (75-300)
II	20-700 (10-320)	6-20 (150-500)
III	40-2000 (20-910)	8-28 (200-700)

B. Riprap must be placed within gabion baskets or stone placed within permeable grout. No loose Class 0, 1, II are permitted.

2.11 GEOTEXTILES

A. Geotextiles shall conform to the class specified in the Contract Documents. The geotextile shall be manufactured from fibers consisting of long chain synthetic polymers, composed of a minimum 85 percent by weight of polyolephins, polyesters or polyamides. The geotextile shall resist deterioration from ultraviolet exposure. Geotextiles used in the construction of silt fence shall contain sufficient amounts of ultraviolet ray inhibitors and stabilizers to provide a minimum of 12 months of expected usable construction life at a temperature range of 0 to 120F (-18 to 49 C).

B. All values specified are minimum or maximum roll values.

C. Classes A through E Geotextiles shall have a 0.010 cm/sec minimum permeability when tested in conformance with D4491, and an apparent minimum elongation of 20 percent when tested for conformance with the grab tensile strength requirements specified below. Classes A through E Geotextiles shall also conform to the following additional requirements:

GEOTEXTILE CLASS	MAXIMUM APPARENT OPENING SIZE mm	GRAB TENSILE STRENGTH lb. (N) min	MINIMUM BURST STRENGTH psi (MPa)
A	0.30	250 (1110)	500 (3.4)
B	0.60	200 (890)	320 (2.2)
C	0.30	200 (890)	320 (2.2)
D	0.60	90 (400)	145 (1.0)
E	0.30	90 (400)	145 (1.0)

D. Class F Geotextiles (Silt Fence) shall have a 50 lb./in. (8.8kN/m) minimum tensile strength and a 20 lb./in. (3.5kN/m) minimum tensile modulus when tested in conformance

with D4595. The material shall also have a 0.3 gal/ft² (12.21/m²) per minute minimum flow rate and a 75 percent minimum filtering efficiency when tested in conformance with D 5141.

E. The properties shall be determined as follows:

TEST	METHOD
Apparent Opening Size	D 4751
Grab Tensile Strength	D 4632, Grab Test – 4 x 8 in. (100 x 200 mm) specimen, 1 x 2 in. (25 x 50 mm) clamps; 12 in. (300 mm)/minute strain rate both principal directions of geotextile.
Burst Strength	D 3786

1. Sewing of the geotextile will be allowed provided it conforms to the following:

   a. Seams shall be either “J” or “butterfly” type and shall utilize a lock stitch.

   b. Seams shall conform to the tensile strength requirements for the geotextile when tested across the seam.

   c. The thread for seaming shall be of equal or greater durability than the geotextile itself.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section 312300- “Excavating, Filling & Grading.”

3.2 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section 312300. Arrange for installation of green detectable warning tapes directly over piping and at outside edges of underground structures.

3.3 PIPING APPLICATIONS

A. General: Include watertight, silt-tight, or soil-tight joints, except where watertight or silt-tight joints are indicated.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.

C. Corrugated Polyethylene (HDPE), Hancor Blue Seal corrugated polyethylene pipe installed per manufacturers’ specifications.

D. Reinforced-concrete sewer pipe and fittings; rubber gaskets; and gasketed joints.

3.4 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for non-pressure applications:

a. Strait-pattern, sleeve type to join piping, of same size, with small difference in outside diameters.

b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.

c. Gasket type to join piping of different sizes where annular space between smaller piping's outside diameter and larger piping's inside diameter permits installation.

d. Internal-expansion type to join piping with same inside diameter.

B. Special Pipe Fittings: Use where indicated.

3.5 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical and in accordance with the requirements of the Baltimore City Specifications and in accordance with the pipe manufacturer's written instructions. Where installation details are not shown on the Drawings, installation shall be in accordance with the Baltimore City Standard Details.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction.

D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited, except as indicated on the plans.

E. Install piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

F. Extend piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

G. Install piping pitched down in direction of flow, at minimum slope of 1 percent (1:100) and 36-inch minimum cover, except where otherwise indicated.

3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to the following.

B. Corrugated Polyethylene (HDPE) Plastic Pipe and Fittings: Join and install in accordance with manufacturer's instructions.

C. Concrete Pipe and Fittings: Install according to ACPA "Concrete Pipe Handbook". Use the following seals:

1. Round Pipe and Fittings: ASTM C 443 (ASTM C 443M), rubber gaskets.

D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems materials and dimensions.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with accessories, as indicated.

B. Form continuous concrete channels and benches between inlets and outlet, where indicated.

C. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.

D. Place precast concrete manhole sections as indicated, and install according to ASTM C 891.

1. Provide rubber joint gasket complying with ASTM C 443, at joints of sections.

2. Apply bituminous mastic coating at joints of sections.

E. Construct cast-in-place manholes as indicated.

3.8 TRENCH DRAIN INSTALLATION

A. General: Install trench drains, complete with accessories, as indicated. Refer to manufacturer's installation instructions.

3.9 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

B. Set cleanout frames and covers in concrete paving with tops flush with Surface of paving.

C. Cleanouts located in paving shall have countersunk lids.

3.11 CLOSING ABANDONED DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either of the following procedures:

1. Close open ends of piping with at least 8-inch-thick brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Structures: Excavate around structure as required and use either of the following procedures:

1. Remove structure and close open ends of remaining piping.

2. Remove top of structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

3. Backfill to grade according to Division 2 Section 312300 - “Excavation, Filling & Grading.”

3.12 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plug in end of incomplete piping at end of day and whenever work stops.

3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visual between structures.

b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedures until results are satisfactory.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours advance notice.

4. Submit separate reports for each test.

5. High density polyethylene “HDPE” pipe: Perform testing in accordance with manufacturer’s recommendations.

6. Where authorities having jurisdiction do not have published procedures, perform tests as follows:

a. Storm Drainage: Perform hydrostatic test.

(1) Allowable leakage is a maximum of 200 gallons per inch nominal pipe size, for every mile of pipe, during a 24-hour period.

(2) Close openings in system and fill with water.

(3) Purge air and refill with water.

(4) Disconnect water supply.

(5) Test and inspect joints for leaks.

(6) Option: Test ductile-iron piping according to AWWA C600, Section 4 “Hydrostatic Testing.” Use test pressure of at least 5 psig.

(7) Option: Test concrete piping according to ASTM C 969.

(8) Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

b. Storm Drainage: Perform hydrostatic test. Close openings in system and fill with water to not less than 10-foot head of water. Disconnect water supply. Water level must not drop for 15 minutes. Inspect joints for leaks.

(1) Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

c. Storm Drainage: Perform air test according to UNI-B-6.

(1) Option: Test round concrete piping, 24 inches and smaller, according to ASTM C 924.

(2) Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

7. Manholes: Perform hydraulic test according to ASTM C 969.

8. Leaks and loss in test pressure constitute defects that must be repaired.

9. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION 334000

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EXHIBIT ONE

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D.W. KOZERA, INC
PROFESSIONAL ENGINEERS AND GEOLOGISTS

Geotechnical Engineering Study

Forest Park Library, 3023 Garrison Boulevard

Baltimore, Maryland 21216



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(410) 823-1060
dwkozera.com

D.W. KOZERA, INC
PROFESSIONAL ENGINEERS AND GEOLOGISTS

May 10, 2024

Penza Bailey, a Studio of PRIME AE Group, Inc.
5521 Research Park Drive, Suite 300
Baltimore, Maryland 21228

Attn: Ms. Laurie Dickeson, AIA, LEED AP, CCS
(laurie.dickeson@primeeng.com)

Subject: Geotechnical Engineering Study, Forest Park Library, 3023 Garrison Boulevard, Baltimore, Maryland (DWK Contract Number 22223.D)

Dear Mrs. Dickeson,

D.W. Kozera, Inc. is pleased to submit this report containing the results of the subsurface investigation and geotechnical engineering study for the Forest Park Library Addition located at 3023 Garrison Baltimore in Baltimore, Maryland. The scope of service referenced in this report was performed per our contract dated November 30, 2022. Soil samples recovered as part of this investigation will be retained in our office for 60 days from the issuance of this report.

We appreciate the opportunity to be of service to you. Please contact us if you have any questions related to this subsurface investigation report.

Very truly yours,
D.W. KOZERA, INC.



Josh Latham, PE
Associate
State of Maryland No. 53276
Expiration Date: 9/24/2024

*I hereby certify that this document was prepared or approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland, License No. **#53276**, and Expiration Date: 9/24/2024.*



Shana Carroll, P.E., LEED AP BD+C
President

Geotechnical Engineering Study
Forest Park Library
3023 Garrison Blvd
(DWK Contract Number 22223.D)

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APPENDICES

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General Notes for Test Borings and Test Pits (1 Page)
Location Plan (1 Page)
Generalized Soil Profile (1 Page)
Test Boring Logs (4 Pages)
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1.0 INTRODUCTION

This report contains the results of our geotechnical investigation and analysis for the proposed improvements at Forest Park Library located at 3023 Garrison Boulevard, Baltimore, Maryland. The report is based on the evaluation of four (4) Standard Penetration Test (SPT) borings, one (1) test pit, and one (1) falling head infiltration test performed on the project site, available geologic data, and our experience on nearby sites.

1.1 Purpose and Scope

This study was conducted to characterize the subsurface conditions, and to establish the engineering properties of the underlying materials to prepare recommendations for the building addition, and geotechnical issues related to the construction of foundation and site work.

The geotechnical investigation was performed per our proposal dated November 30, 2022. The subsurface investigation was comprised of four (4) SPT test borings to depths ranging from 16 to 26 feet, and one test pit to a depth of 5 feet below grade. Depths are measured from existing grades. Our scope of work included:

a) Review of our test procedures, results of all testing conducted, and available geotechnical and geological data from our previous studies.

b) Description of site geologic and groundwater conditions.

c) Presentation of subsurface soil stratigraphy with pertinent available physical properties.

d) Recommendations for a shallow foundation system or deep foundation system including allowable soil bearing pressure, anticipated settlements, and embedment depth for frost. This includes allowable soil bearing pressures for underpinning design.

e) Slab-on-grade design recommendations for the building addition including the modulus of subgrade reaction, k, in pounds per square inch to be used to design the concrete slab-on-grade for the buildings.

f) Recommendations for foundation drains and considerations, dewatering procedures, if applicable.

g) Determination as to whether on-site material will be suitable for use in controlled fills, the extent to which acceptable on-site materials will be available, and if off-site borrows will be required.

h) Concept design infiltration testing, in general accordance with the 2000 Maryland Stormwater Management manual.

i) General recommendations for Stormwater Management facilities.

j) Site-specific seismic classification per IBC 2018.

k) Recommendations on monitoring construction procedures including construction control measures, as well as recommended installation, and monitoring of validation tests or instrumentation.

1.2 Limitations

This geotechnical study has been prepared following the generally accepted geotechnical engineering practices. It is intended for the exclusive use of Penza Bailey, a studio of PRIME AE Group, Inc. for the design and construction of the proposed addition and site work as described herein. This report includes both factual and interpreted information. Factual information is defined as objective data based on direct

observations, such as soil samples and laboratory testing results. Interpreted information or geotechnical engineering interpretation is based on engineering judgment, correlation, or extrapolation from factual information.

This report is based on information for the proposed structure that was made available to us at the time of the writing of this report. No warranties, express or implied, are intended or should be assumed. D.W. Kozera, Inc. should be allowed to review the project drawings and specifications as a continuation of our design recommendations and as a precursor to our providing geotechnical engineering services during construction. In the event that any changes in the floor grades, building loads, or structure location as described in this report are planned, the conclusions and recommendations contained herein shall not be considered valid unless D.W. Kozera, Inc. reviews the changes, and either verifies or modifies the conclusions of this report in writing.

Information contained in this report is based on data obtained from limited subsurface exploration that represents the soil conditions only at the specific location and time investigated, and only to the depth penetrated. Subsurface conditions and groundwater levels at other locations or depths may differ from conditions occurring at the investigated locations. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

D.W. Kozera, Inc. considers construction observations and testing of the foundations and earthwork an integral part of geotechnical design, and therefore, these services should be provided by the geotechnical engineer of record. This is necessary so that we may modify our assumptions and recommendations based on actual conditions that are exposed during construction and observed by us. We cannot assume responsibility or liability for the adequacy of our foundation recommendations if we do not observe the construction.

1.3 Site Description and History

The site is located at 3023 Garrison Boulevard, Baltimore, Maryland. There is a 5,424 sf multi-story library building in the center of the site bound by Garrison Boulevard to the southwest, Fairview Avenue to the north, and Callaway Avenue to the east. Existing site grades slope downward from the southwest to northeast ranging from approximately EL +412 to EL +409. The location of the site is depicted in Figure 1.3.1.

Based on historical topography from 1894, the site prior to the development of the library appears to have been undeveloped land leading to the historic Williams Run that was later piped and backfilled for construction of Lake Ashburton and residential areas east-northeast of the site sometime prior to 1927. The central portion of the library was originally established in 1910 and later developed with additions to the northwest and southwest sides of the 1910 structure in 1953. Figure 1.3.2 depicts historical topography from 1894 and the approximate property boundary.

Historic plans of the existing structure and the 1953 addition were provided and indicate the existing structure is supported by shallow foundations and the 1910 structure has a basement. Based on the recent topography provided by MK Consulting Engineers, LLC and the historical plans, the lowest level of the existing 1910 structure is estimated to be EL 405.4±. The 1953 additions are understood to have the lowest floor grades near existing exterior grades and not to have basements. Based on the available information, the existing shallow foundations for the 1953 additions step down to the 1910 structure basement elevation at approximate elevations ranging from EL 408.4± to EL 404.4±. The historical foundation plan view and architectural elevations of the 1953 additions is shown below in Figures 1.3.3 and 1.3.4.

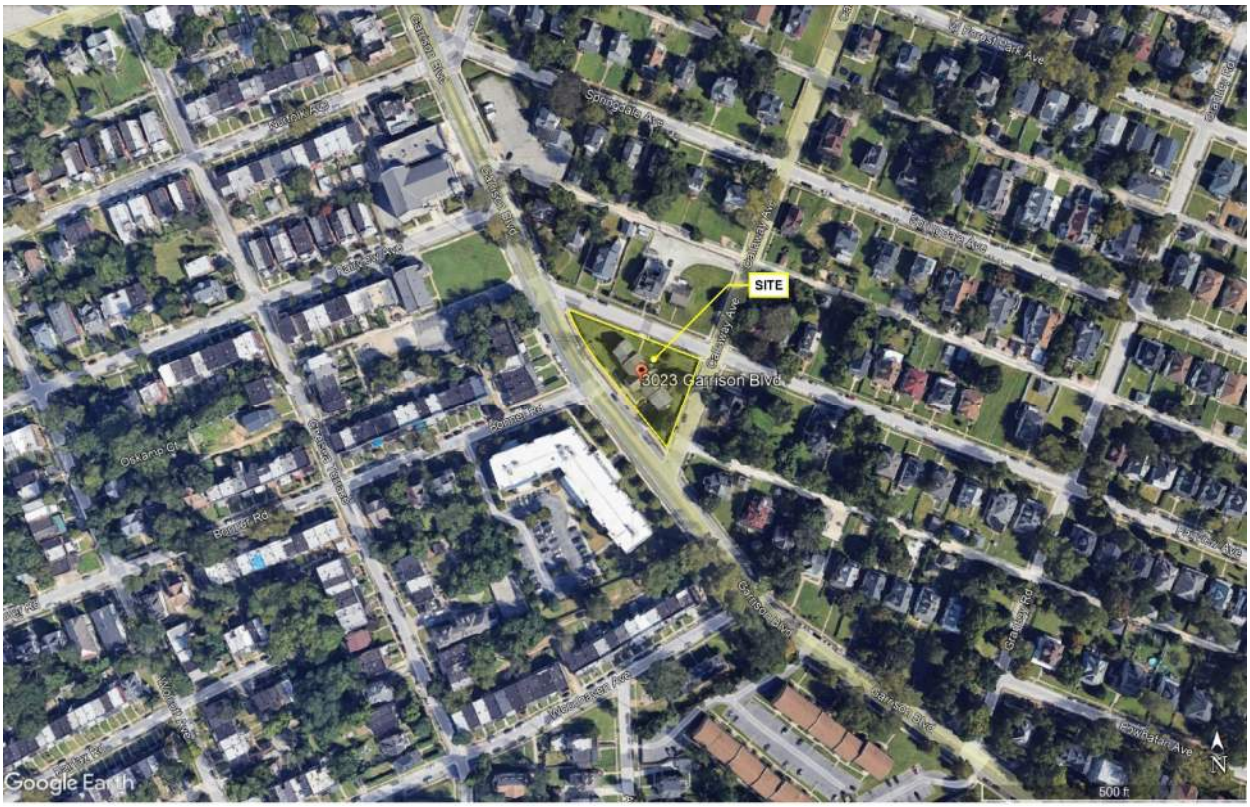


Figure 1.3.1 - Site Vicinity Map

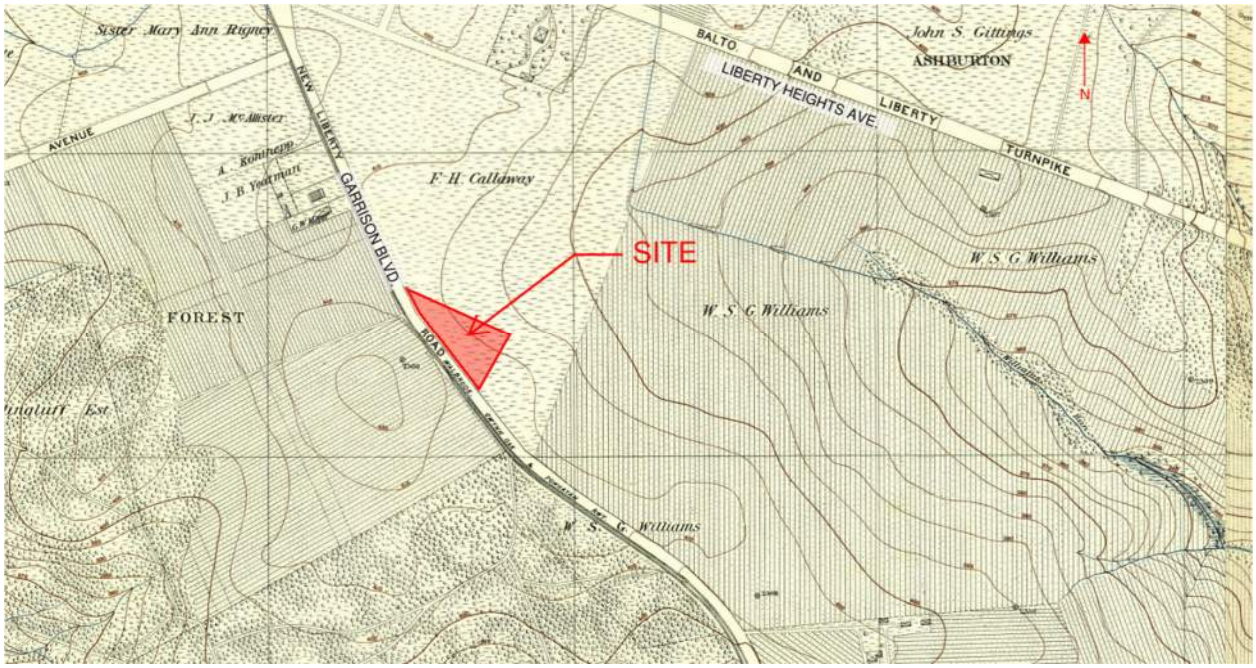


Figure 1.3.2 - 1894 Topography and Approximate Property Boundary

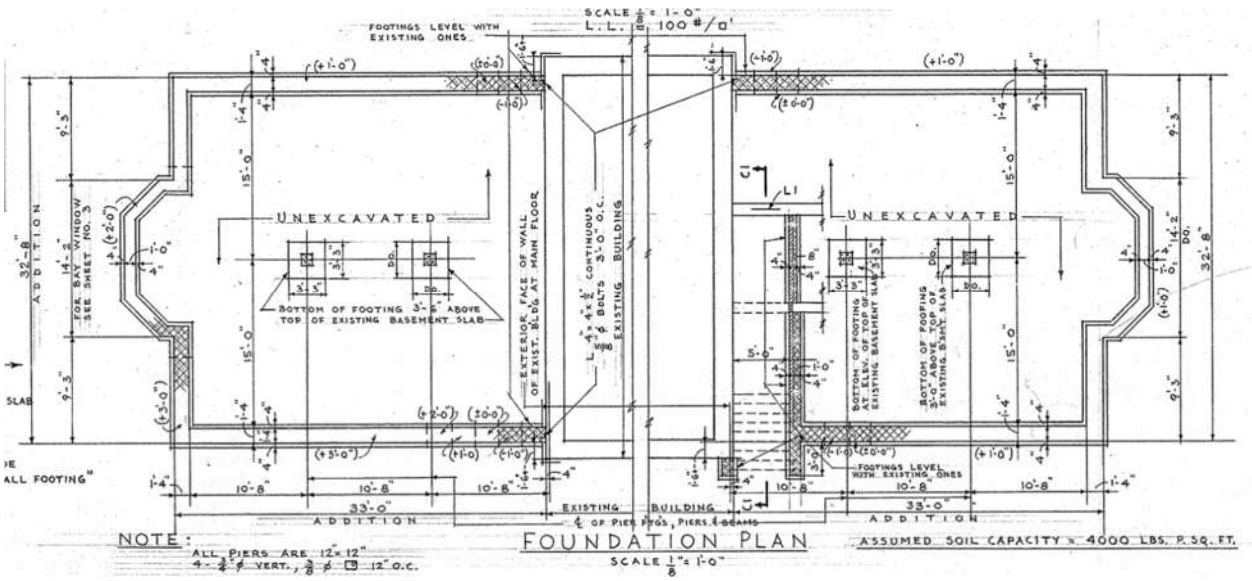


Figure 1.3.3 - Foundation Plan for 1953 Additions



Figure 1.3.4 - Architectural Rear Elevation for 1953 Additions

1.4 Proposed Construction

A new single story building addition, underpinning, a stormwater management (SWM) facility, and site improvements for the existing site. The addition will be constructed of steel framing supported by masonry walls. The new single-story addition is planned on the northeast portion of the site and will tie-in to the existing 1910 library structure. The finished floor elevation of the new addition will be EL 409.7 and will step down to match the basement level of the existing structure at EL 405.4±. A new stairwell and elevator pit is planned and an electrical room to be added in the basement of the existing structure. The anticipated lowest excavation level associated with the elevator pit, stairwell, and electrical room is planned at EL 400.4±. The proposed exterior building walls will be masonry and masonry piers will be located where large, concentrated loads occur along the bearing walls. Structural loading was provided on a plan titled “Soil Boring Exhibit” prepared by MK Consulting Engineers, LLC which indicate that maximum column and wall loads will be 25 kips and 3.5 kips per linear foot, respectively. Due to the anticipated excavation depths and foundation bearing elevations relative to the existing structure’s, underpinning portions of the existing exterior wall foundations are planned. Based on the provided plans, we understand sequenced concrete trenches are planned for the underpinning.

Site improvements will include new sidewalks, concrete pavers, seat walls, and a micro-bioretention SWM facility. One boring was requested for the proposed SWM facility with an infiltration test elevation requested at EL 396.62. Based on the provided grading plans, proposed site grades range from EL 406 to EL 418, resulting in cuts and fill less than 5 feet from existing grade associated with the site improvements, apart from excavations planned for the proposed building addition, tie-ins to the existing structure, and SWM facility. The deepest excavations are anticipated to be associated with excavation of the SWM facility, foundation excavation, and underpinning associated with the existing library structure, which will be on the order of 8 to 10 feet below existing grades. Figure 1.4.1 depicts the proposed grading plan prepared by Prime AE included with the 60% Design Development plan set dated October 14, 2022.

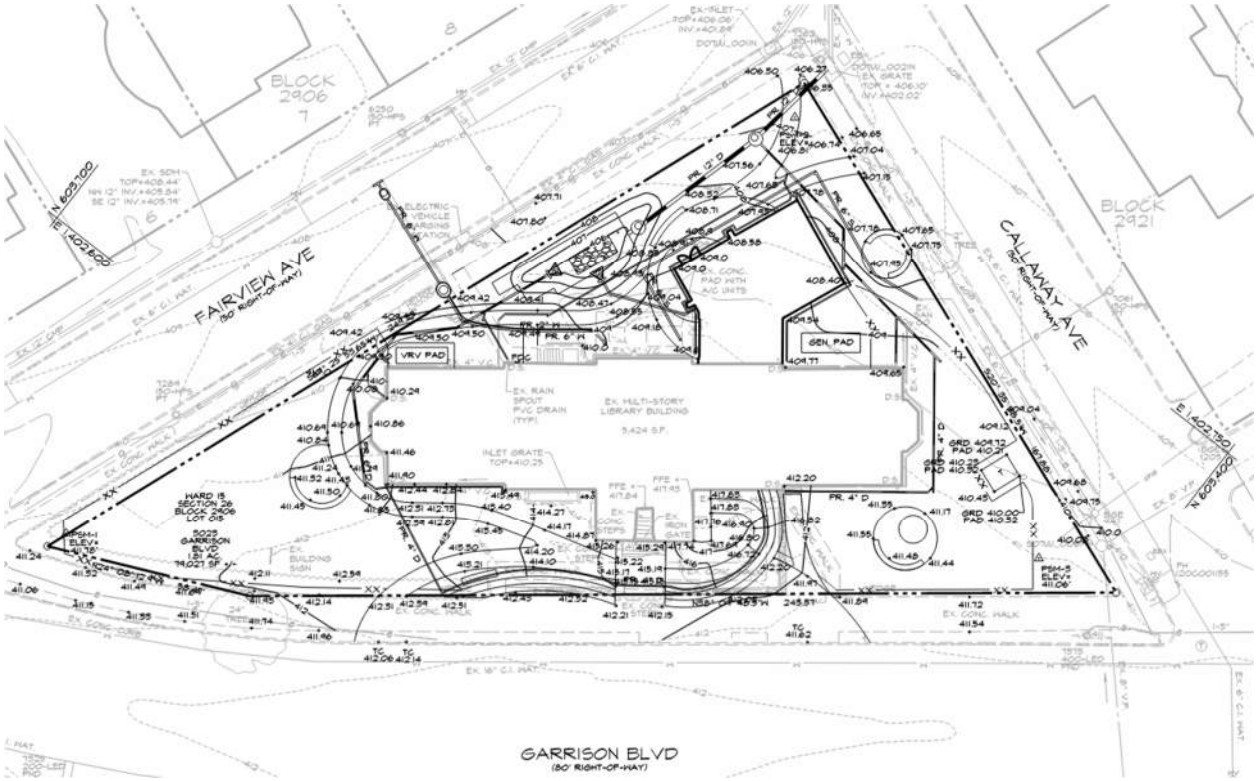


Figure 1.4.1: "Site and Grading Plan" prepared by PRIME AE dated January 23, 2023

1.5 Regional Geology

The project is located within the Piedmont Physiographic Province characterized by a gently rolling to flat surface with a moderately to strongly deformed geologic structure. According to the Geologic map of the Baltimore West quadrangle, Maryland, prepared by Crowley, W.P., and Reinhardt, Juergen, published by Maryland Geological Survey, 1979 (Figure 1.5.1), the site is mapped in the Hollofield Layered Ultramafite (h), described as "Ultramafic and mafic rocks interlayered on a scale varying from centimeters to tens of meters. Chiefly actinofels and actinoschist with subordinate and very subordinate serpentinite.

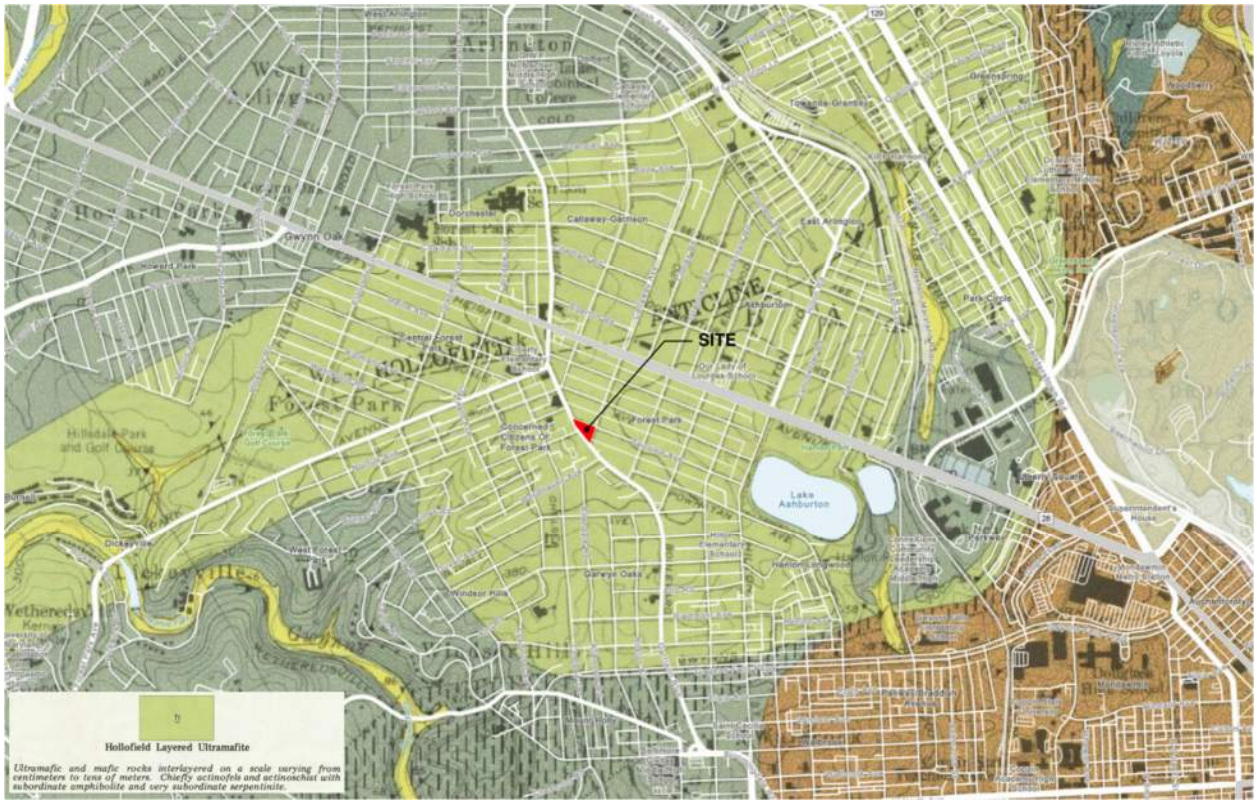


Figure 1.5.1: Site Geology Map

It has been our experience that the upper residual soils weathered from this geologic formation will produce highly plastic Fat Clays (CH) and Elastic Silts (MH). Such residual soils were encountered below the existing man-placed fill in all of the borings and boring B-1 encountered auger and SPT refusal at a depth of 26 feet below existing grade, corresponding to EL 383±. This was generally consistent with the referenced geological mapping and the "Map of Baltimore City Showing the Amount of Overburden Covering The Underlying Rock" based on information secured by C.W.A. Workers and compiled by Edward Bennett Mathews, dated 1935. Based on the aforementioned overburden map, we anticipate the underlying bedrock in the vicinity of the site should range between 20 to 30 feet below existing grades as shown in Figure 1.5.2. This is consistent with observations in Boring B-1 where auger and SPT-N refusal (i.e., SPT-N $\geq$ 50/1") was encountered at a depth of 26 feet below the existing grade, corresponding to EL 383±. Rock coring

was beyond the scope of this exploration, however, based on published literature and our experience in the area, we have inferred this to be the apparent bedrock surface at this particular location.



Figure 1.5.2 - 1935 Map of Baltimore City Showing the Amount of Overburden Covering the Underlying Rocks

2.0 SUBSURFACE INVESTIGATION

2.1 Field Investigation

The subsurface investigation was performed on April 1, 2024. It included drilling a total of four (4) SPT borings to depths of 16 to 26 feet below existing grades, one (1) test pit, and one (1) falling head infiltration test using cased borehole methods.

The locations of the soil test borings are shown in the Exploration Location Diagram, Appendix A. The borings were drilled using an Acker Recon track-mounted drill rig equipped with an automatic hammer to obtain SPT samples. The test borings were monitored for groundwater levels during the drilling operations and after 24 hrs. A temporary slotted standpipe piezometer was installed in boring B-1 and borings B-3 and SWM-1 were left open and covered for approximately a month to facilitate water readings. Borings B-1, B-3, and SWM-1 were backfilled with drill spoils upon completion of the stabilized groundwater readings. Boring B-2 was backfilled upon completion.

It is important to note that inclement weather was encountered the week of the exploration, precipitating the need for continued groundwater operations.

2.2 Soil Test Borings

Test borings were advanced using hollow-stem augers (3.25-in. inner diameter (ID) hollow-stem auger (HSA)) and soil samples were recovered from the borings at selected intervals by driving a 1-3/8-inch ID (2-in. outer diameter (OD)) split-spoon sampler following ASTM D-1586 specifications. SPTs were conducted at changes in strata or at intervals not exceeding five feet. The sampler was first seated about 6 inches to penetrate through the loose cuttings and then driven an additional 1 foot with blows of a 140-pound automatic hammer falling 30 inches. The number of hammer blows required to drive the sampler on the final foot is designated as the Standard Penetration Resistance N-value. Soils obtained from the sampling device were sealed in glass sample jars and transported to the soil testing laboratory.

The recovered soil samples were inspected and classified by a Geotechnical Professional using the ASTM Soil Classification System (ASTM D 2488). A description of the soils and conditions encountered at each test boring location is presented on the Boring Logs and is included in Appendix A.

2.3 Test Pits

A test pit was performed on the rear side of the existing 1910 library structure with the intention of exposing the existing building foundations for observations. The test pit was extended to a depth of approximately five feet below existing grade and encountered what appeared to be communication lines in the excavation. Due to the uncertainty of the utilities encountered and potential safety concerns, Prime AE was notified that the test pit could be completed and was backfilled prior to exposing the existing building foundations. The test pit and boring locations were coordinated with Miss Utility and Inframap prior to excavation. A snip of the “Subsurface Utility Engineering Plan, Forest Park Branch Library, Baltimore, Maryland” dated March 21, 2024, prepared by Inframap with the test pit location is shown below in Figure 2.3.1. Based on the provided plan, utilities were not indicated in the area of the test pit prior to excavation.

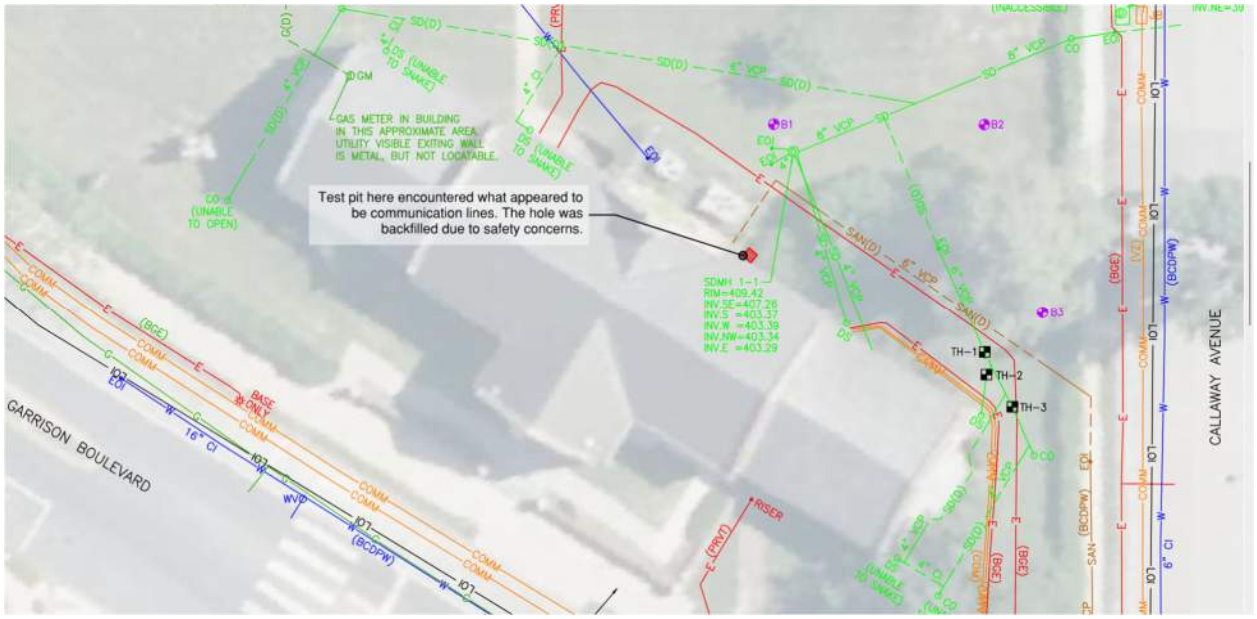


Figure 2.3.1 - March 21, 2024, Inframap SUE Plan and Test Pit Location

2.4 Soil Laboratory Testing

Soil samples recovered from the field explorations were transported to the laboratory and selected soil samples were tested to determine additional engineering characteristics of the existing on-site soils. Laboratory tests conducted on the selected soil samples include Natural Moisture Content (ASTM D2216), Atterberg Limits (ASTM D4318), and Sieve Analysis (ASTM D6913). Summary and details of the results of these laboratory tests are included in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 Stratification

The Boring Logs included in Appendix A contain details related to the subsurface conditions encountered at the test boring locations. Stratification lines shown on the Boring Logs and the Generalized Subsurface Profile in the Appendix represent approximate transitions between material types. Strata changes can occur gradually or at different levels than those shown on the Boring Logs that depict conditions at the specific indicated locations and depths at the time of our subsurface exploration program. Groundwater levels are variable and are influenced by the existing soil conditions, seasonal and climatic changes. The test boring data, visual and laboratory classification of the sampled soils, and our knowledge of local geology were used to separate the soils into two (2) geologic strata below the near-surface materials, having the following generalized properties.

3.1.1 Stratum A: Man-Placed Fill

Man-placed fill was encountered below the surficial materials in all four test borings. The fill material was observed to consist of Sandy Fat Clay (CH), Sandy Lean Clay (CL), Sandy Elastic Silt (MH), and Sandy Silt (ML) with trace to few amounts of roots, gravel, and rubble. The fill appears to have been placed during past construction and grading activities at the site. The fill stratum extended to depths ranging approximately from 6 to 8.5 feet below the existing grade corresponding to bottom of fill elevations of EL 399.5± to EL 402±. The penetration resistance in the Man-Placed Fill indicated a generally low relative consistency with Standard Penetration Test (SPT) N-values ranging from 3 blows per foot (bpf) to 13 bpf.

3.1.2 Stratum B: Residual Soils

Residual soils were encountered below the Man-placed Fill to depths of 16 to 26 feet below existing grades. The residual soils were classified as Sandy Elastic Silt (MH), Sandy Silt (ML), and Silty Sand (SM), fining upward. The penetration resistance in the Residual Soils indicated a generally low relative consistency to medium-dense density with SPT N-values ranging from 5 bpf to 34 bpf.

Boring B-1 encountered auger and SPT-N refusal (i.e., SPT-N $\geq$ 50/1") at a depth of 26 feet below existing grade, corresponding to EL 383±. Rock coring was beyond the scope of this exploration, however, based on published literature and our experience in the area, we have inferred this to be the apparent bedrock surface at this particular location. Auger and SPT refusal should not be relied on as the only determining factor of this actually being bedrock. Rock coring would need to be performed to verify this is actually bedrock and not a Residual boulder.

3.2 Groundwater Conditions

Groundwater was encountered in all of the borings at depths ranging from 3.5 to 15 feet below existing grades, corresponding to elevations ranging from EL 404.5± to EL 394±. During the exploration, erratic water readings were encountered to substantial rain during and after the explorations (i.e., surface runoff in the boreholes). Due to this condition, a temporary slotted standpipe piezometer was installed in boring B-1 and borings B-3 and SWM-1 were left open and covered for approximately a month to facilitate stabilized water readings. Stabilized water was encountered in borings B-1 and SWM-1 at depths ranging from 8 to 8.8 feet below existing grade, corresponding to an elevation of approximately EL 400±. Based on the stabilized water readings, we anticipate sustained groundwater will be encountered at elevation at or below EL 400±, however, localized perched water will likely be encountered in the existing fill.

It should be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, construction activities, etc. Note also that the highest groundwater observations are normally encountered in late winter and early spring. Regardless of the information presented here, the contractor shall make their own

assessment of the dewatering needs for the project. Please refer to the boring logs in Appendix A for groundwater readings.

4.0 SEISMIC CONSIDERATIONS AND SITE CLASS

This section presents the testing and analysis conducted to evaluate the liquefaction potential of the soils; and the seismic site class for this project site per 2018 International Building Code (IBC).

4.1 Liquefaction Potential

Liquefaction typically occurs in loose, cohesionless sands located below the water table. As these conditions are not present at this site, no further liquefaction analysis is warranted.

Based on our investigation and engineering judgment, the building site is not susceptible to liquefaction under the design earthquake magnitude mandated by the code.

4.2 IBC 2018 Seismic Site Class

The Seismic Site Classification influences the determination of the Site Coefficients, the Design Spectral Response Acceleration values, and ultimately the Seismic Design Category. Note that the Seismic Site Classification is based on the characteristics of the upper 100-feet of soil below the site. The IBC requires the use of Standard Penetration Test Resistance (test borings), Shear Wave Velocity (geophysical methods), and/or Undrained Shear Strength (soil laboratory testing) to categorize the Seismic Site Classification. Based on the test borings performed at this site and our interpretation of the geology below the depth of the test borings, the Seismic Site Classification was determined to be **Site Class D**. If a higher site classification is beneficial to the project we can provide additional testing, such as ReMi or MASW shear wave studies, that may yield more favorable results.

5.0 EARTHWORK

Careful subgrade preparation, including stripping of existing asphalt, organic layers, topsoil, and/or soft surface soils, is required to prepare a suitable fill subgrade. Based on the provided grading plans, proposed site grades range from EL 406 to EL 418, resulting in cuts and fill of less than 5 feet from the existing grade associated with the site improvements, apart from excavations planned for the proposed building addition, tie-ins to the existing structure, and SWM facility. The deepest excavations are anticipated to be associated with the excavation of the SWM facility, foundation excavation, and underpinning associated with the existing library structure, which will be on the order of 8 to 10 feet below existing grades. Considering the anticipated excavation depths, we anticipate most the excavated soils to consist of Man-Placed Fill and Residual soils. The majority of the laboratory test results and visual classifications from the recovered SPT samples in both of these strata resulted in classifications of moderately plastic Lean Clay (CL) and Silt (ML) to highly plastic Fat Clay (CH) and Elastic Silt (MH), well above allowable moisture contents to readily achieve compaction.

We anticipate most of the on-site soils to be unsuitable for reuse as structural fill and to be highly sensitive to moisture which will make them difficult to work with during construction. Groundwater is anticipated to be encountered at elevations at or below EL 400± with higher zones of localized perched water. Based on the anticipated excavation depths, we suggest the owner carry a contingency for importing suitable structural fill for the project and the contractor be prepared to dewater as needed to provide a dry and stable working grade. Earthwork is recommended to take place in the warmer, drier months between May and October. The use of scarification and drying techniques, or additives such as quick lime or Portland cement may also be useful in expediting fill operations in inclement weather.

5.1 Excavation Characteristics

Most of the site excavation is expected to be performed using conventional earthmoving equipment, provided the planned excavations are positively drained and/or sufficiently dewatered prior to and during excavations. Careful preparation of fill subgrades as well as proper placement and compaction of structural fill and backfill are both necessary to prepare a suitable site for the support of the proposed structures. Groundwater was encountered just below the planned excavation depth for the elevator pit and electrical room foundations; however, localized perched water may be encountered at higher elevations in the Man-Placed Fill. **Dewatering during construction will be critical, especially for the preparation and placement of the foundations and slab on grade**.

5.2 Fill and Floor Slab Subgrade Preparation

All surficial materials (vegetation, topsoil, pavements) located below the proposed improvements should be removed from the subgrade prior to filling. The resulting subgrades should be proofrolled under the observation of the Geotechnical Engineer of Record to identify any unsuitable soft and loose soils. Proofrolling should be performed using fully loaded large off-road dump trucks traveling at speeds less than 2 feet per second. Unsuitable soils that are observed to be excessively settling or to be pumping during proofrolling, should be removed down to firm soils and then replaced with satisfactory soil materials compacted in accordance with the project specifications.

The on-site soils will become unstable in wet weather and under construction traffic. Undercutting of subgrades should be expected and the extent of undercutting will increase if the subgrades are exposed to the above events. The Project Specifications should require the contractor be responsible for protecting the subgrades from weather and equipment damage.

Considering the presence of existing Man-placed Fill, soil types, and the low SPT-N resistances encountered near the proposed floor grade at EL 409±, **we anticipate that the existing soft soils will be incapable of passing a proofroll, therefore, we recommend the owner carry a contingency for undercutting slab subgrades 2 feet and repair with compacted structural fill.**

5.3 Compacted Structural Fill

Compacted structural fill and backfill should consist of satisfactory soils classified as SM or coarser in accordance with the Unified Soil Classification System, ASTM D2487. Soils meeting this requirement are classified as SM, SP, SW, GM, GP, and GW. Unsatisfactory soils are those classified as CL, ML, OL, OH, MH and CH. **The majority of the on-site soils are not expected to meet this requirement and we recommend planning to import structural fill and we recommend that the Owner budget for the off-site export of any cut soils.**

Soils used for compacted fill should be mineral soils free of unsuitable materials such as topsoil, other organics, rubble, and rocks larger than three inches in diameter. The in-place moisture content of the satisfactory soils material shall be adjusted by the contractor through wetting or drying, to within three percent of the optimum moisture content. Most of the on-site soils are expected to have moisture contents well above the optimum for compaction, therefore, we recommend planning to import structural fill.

Compacted fill should be placed on subgrades which have first been stripped of vegetation, existing asphalt, topsoil, and unsuitable soft areas. Compacted structural fill should be placed in approximately horizontal layers, each layer having a loose thickness of not more than eight inches. All structural fill in the building and pavement areas should be compacted to 95 percent of the maximum dry density in accordance with ASTM D698, Standard Proctor. Compacted fill in lawns and unpaved areas may be compacted to 90 percent of the same standard, when placed as indicated above. The contractor should select appropriate compaction equipment to achieve the required compaction.

5.4 Dewatering During Construction

Groundwater is anticipated to be encountered at elevations at or below EL 400± with higher zones of localized perched water. Based on the anticipated excavation depths, we suggest the contractor be prepared to dewater as needed to provide a dry and stable working grade. At a minimum, the contractor should plan to have sumps and pumps available to control groundwater encountered in excavations and to control surface runoff into excavations during construction to maintain dry excavations and to protect working grades. Regardless of whether groundwater was encountered during the exploration, the contractor should make their own determination of the dewatering needs for the project. It is also important to note that seasonal variations can impact the groundwater throughout the year.

6.0 FOUNDATION RECOMMENDATIONS

Foundation loads were provided by the structural engineer who indicated that maximum column loads of 25 kips and maximum wall loads of 3.5 kips per linear foot should be expected. The finished floor elevation of the new addition will be EL 409.7 and is expected to step down to match the basement level of the existing structure at EL 405.4±. A new elevator pit is planned at the building tie-in and an electrical room is to be added in the basement to the existing structure. Foundation bearing elevations for the at-grade portion of the building addition are currently planned to step down from the northeast to the tie-in at the existing library at elevations ranging from EL 406± to EL 400.4±, respectively. The lowest foundation bearing elevation planned is at the building tie-in and the electrical room addition.

As previously mentioned, Man-Placed Fill extended to depths ranging from approximately 6 to 8.5 feet below the existing grade which corresponds to the bottom of Fill elevations of EL 399.5± to EL 402±. Based on the planned bearing elevations and depth of Man-Placed Fill encountered in the borings, we anticipate that 1 to 6 feet of soft, uncontrolled existing Man-placed fill would remain below the anticipated foundation bearing elevations. New foundations supported by soft uncontrolled fill will likely experience intolerable settlements, therefore, we have provided four options to support the proposed building addition:

1) Lower shallow foundations to bear on suitable natural soils.
2) Undercut and replace the existing fill and support shallow foundations on compacted structural fill.
3) Supporting the new structure on helical piles
4) Supporting the new structure on Ductile Iron Micropiles (DIPs)

Out of the four options, we anticipate that helical piles (Option 3) will be the most cost effective, as opposed to an earthwork solution requiring substantial exporting and importing structural fill. Removal and replacement will still be require for floor slab support and behind retaining walls for any of the option presented. Other options, such as ground improvements were considered, however due to the proximity of existing structures, size of the project, and relatively light structural loads, it's our opinion that the four options presented will be the most cost efficient, provided the willingness of the contractor to implement the recommendations in accordance with our recommendations.

6.1 Spread Footings (Options 1 and 2) - General

We expect a total foundation settlement of less than one inch, which can be expected when foundations are placed per the recommendations provided in this report and D.W. Kozera has approved the bearing subgrades prior to concrete placement. At the new foundations planned in the existing structure, we anticipate the total settlement will be 0.5 inches or less and that settlements of the existing foundations should remain below 1 inch or less. Our understanding of the existing foundations and existing loading is based on historical structural plans.

To preclude punching type bearing capacity failures, wall footings shall have minimum widths of 24 inches, and any column footings shall have minimum widths of 36 inches. A maximum slope of 2H:1V should be maintained between the bottom edges of adjacent footings where foundation grades are at different levels. All footings in non-climate-controlled portions of the structures should be placed at least 30-inches below the final grade for frost protection. It is also recommended that wall footings be provided with adequate reinforcement so that sufficient bending strength is available to span isolated pockets of soft or loose soils (that may go undetected during construction).

D.W. Kozera should be scheduled to observe all bearing subgrades prior to concrete placement.

6.1.1 Shallow Foundations on Natural Soils (Option 1)

To minimize the risk of intolerable settlement due to the presence of existing Fill, foundations for the proposed building addition could be lowered to bear on suitable residual soils of Strata B. Man-Placed Fill extended to depths ranging approximately from 6 to 8.5 feet below existing grade corresponding to bottom of fill elevations of EL 399.5± to EL 402±. Foundation bearing elevations for the at-grade portion of the building addition are currently planned to step down from the northeast to the tie-in at the existing library at elevations ranging from EL 406± to EL 400.4±, respectively. Based on the planned bearing elevations and depth of Man-Placed fill encountered in the borings, we anticipate that the planned foundation bearing elevations would need to be lowered 1 to 6 feet to bear on natural soils suitable for supporting shallow foundations. The foundations would need to be lowered the most at the at-grade portion of the proposed addition and underpinning of the existing structure. Perched water was noted at the interface of the Man-placed Fill and the natural Residual soils in Test Borings B-1 and B-2 and should be expected during construction of spread footings if this option is selected. Due to the risks of cost increases during construction due to dewatering, and the anticipated cost of overexcavation of the soils below the bottom of the proposed footing, we do not believe this will be the most economic option for support.

An allowable soil bearing pressure of 2,000 pounds per square foot is expected to be feasible for column and wall footings used to support the new or existing structural loads when founded on the compact Residual soils of Strata B. It is important to note that the existing library is reported to have foundation bearing elevations at the proposed addition tie-in ranging from EL 406.4± to EL 404.4±, which will require underpinning to match the lowered foundations for the new building addition to reduce the risk of intolerable differential settlement and undermining existing foundation bearing subgrades.

During excavation for footings, some unsuitable loose natural soils below the existing Fill soils may be encountered, which must be removed by undercutting. The footings should be placed directly on the lowered subgrade. Alternatively, the undercut subgrade may be backfilled with lean concrete.

6.1.2 Shallow Foundations on Compacted Structural Fill (Option 2)

In lieu of lowering the footings to natural soils, the contractor may elect to replace undercut materials beneath the footings with compacted structural fill in accordance with Section 5 of this report. The footings can then be set at frost depth (exterior) or nominal structural depth (interior climate-controlled spaces). An allowable bearing pressure of 2,000 psf is recommended for the design of spread footings founded on compacted structural fill supported by natural soils. This recommendation is only feasible in areas of the at-grade portion of the proposed addition. Where the proposed addition begins to step down towards the building tie-in, specifically at the proposed stairwell and elevator pit, new foundations should not bear within a 2H:1V zone of influence of adjacent foundations.

If the contractor chooses to undercut and replace unsuitable footing subgrades with compacted structural fill, the footing subgrades should be over-excavated at a 1H:1V outward beyond the edge of the footing per Figure 6.1.1. It may prove economical to undercut and replace portions of the building pad in a mass grading process prior to footing installation. Alternatively, the foundation over-excavations could be repaired with lean concrete, which would result in an over-excavation neat to the width of the proposed foundation. Foundation undercuts repaired with lean concrete should be allowed to cure so that new foundations can be constructed on hardened lean concrete. Prior to placement of any compacted fill or lean concrete below building areas, D.W Kozera should be scheduled under a separate contract to observe and approve the undercut subgrade.

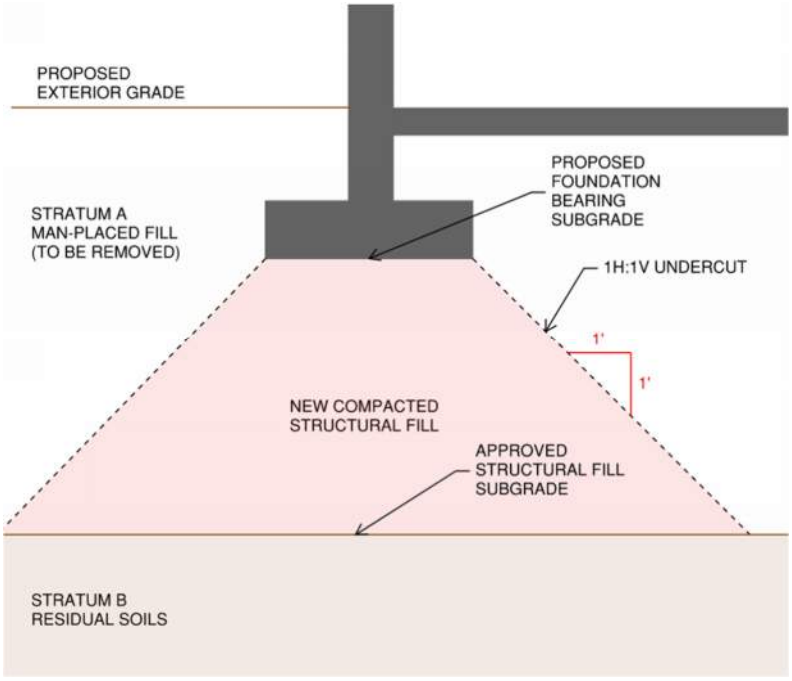


Figure 6.1.1 - Minimum Undercut Zone for Foundations on Compacted Structural Fill

As noted in the discussion for Option 1, perched water was noted at the interface of the Man-placed Fill and the natural Residual soils in Test Borings B-1 and B-2 and should be expected during construction of spread footings if this option is selected. Due to the risks of cost increases during construction due to dewatering, and the anticipated cost of overexcavation and replacement of the soils, we do not believe this will be the most economic option for support.

6.2 Helical Piles (Option 3)

As an alternative to an earthwork solution, helical piles could be installed through the Man-placed Fill into dense Residual soils of Stratum B. Helical piles with square shaft and round helical plates attached to the lead section are recommended for this project. These piles will derive their compression capacity from end bearing. Due to the lower density/consistency of some of the soils encountered during our exploration, the helical designer should consider buckling of the helical piles. They are typically installed using earth moving equipment fitted with rotary hydraulic attachments. A recommended allowable capacity per pile of 20 kips in compression and 10 kips in tension is considered feasible and can be used for budgeting purposes. D.W. Kozera should be retained to review plans, specifications, shop drawings, submittals, and installation for these recommendations to be valid.

If more than one helical pile is required per column, a minimum center-to-center distance of 3.0 pile diameters, with the pile diameter considered to be the largest helix diameter of a multi-helix pile, should be used. A minimum of three piles per group should be installed in each pile cap. Per IBC, all piles shall be laterally braced. Lateral bracing can be achieved by arranging three or more piles under an isolated column or arranging two piles spaced one on each side of a wall or grade beam. Lateral bracing of piles supporting continuous walls can also be achieved by staggering the piles.

Per IBC, helical piles should be embedded a minimum depth of 3-inches into concrete pile caps or grade beams. Deeper embedment is required for fixed pile head conditions or to resist uplift forces. The connection between the pile and concrete is commonly achieved using a steel plate cap or “new construction bracket.” The plate should be sized and embedded so as to resist 1-way and 2-way concrete punching shear. The final connection geometry, embedment, and details should be designed by the Structural Engineer of Record to consider all loading at the pile cap.

A static load test per ASTM D1143, Procedure A, will be necessary to evaluate the estimated capacity and settlement of the helical pile system. The test pile must be loaded to at least 200% of the design load or failure. If failure occurs prior to 200% of the design load, then the design load must be reduced to a maximum value of 50% of the load at failure. This test should be performed prior to the installation of production piles and should not be performed at a production pile location. It is recommended that, after successful completion of Procedure A, an overload test be performed to 300% of the design load, following ASTM D1143, Procedure C.

The pile contractor should have at least 5 years of specialized experience in helical pile installation and experience with at least 25 projects in similar soil profiles. The contractor should provide the design, material, and methods that will provide the recommended load capacity in the Issued for Construction Plans. We recommend that the specialized contractor be provided with a copy of this report. The contractor should prepare the actual foundation design and shop drawings stamped by a Professional Engineer registered in the State of Maryland which should be submitted to the structural engineer and D.W. Kozera, Inc., for review prior to construction. The contractor should provide a design that limits total settlement, which includes settlement during construction of the addition to 0.5-in. and differential settlement should be limited to 0.25-in. or less between adjacent columns, unless otherwise allowed by the structural engineer.

Tolerance for helical pile placement is typically +/-1-inch horizontal, +/-1/8-inch elevation, and +/-3 deg orientation/inclination. Helical piles installed out of tolerance should be removed and repositioned. Installation torque and depth should be measured and recorded during helical pile installation at 3-foot intervals. Torque measurement equipment should be calibrated annually to NIST standards. Installation torque should be used to determine termination depth and pile acceptance by applying commonly recognized capacity: torque relationships such as those provided in Perko (2009) or ICC-ES AC358. Until a proper final torque is achieved, continue to add extension sections to further advance the helical pile.

In order to develop the recommended design capacity of 20 kips in compression and 10 kips in tension, our analysis indicated that CHANCE® Type SS175 helical piles having 3 helices with diameters of 8, 10, and 12 inches embedded into the dense residual soils of Stratum B. Dense residual soils are anticipated at depths ranging from 20 to 25 feet below existing grades. We recommend that the helical piles be grouted to provide corrosion protection. CHANCE grouted helical piers are referred to as Helical Pulldown® Micropiles. Installation of helical piles should be observed by a representative of our firm to document pile depth, pile size, and installation torque. This is of particular importance on this project as the depth to dense Residual soils are expected to vary across the site and difficult installation in the Man-placed Fill is expected due to potential rubble.

There are many helical anchor suppliers in the market and the dimensions of the shaft, and the size and type of the helical bearing plates are determined based on factors such as drivability, soil properties and loading. Alternate helical anchor types and/or configurations may be used by the installer provided that the helical piles are manufactured by an ISO9001 accredited quality manufacturer with a history of product testing, have a minimum ultimate capacity of 40 kips, and the design and quality control procedures are approved by our office. Installation of helical piles should be recorded by the contractor and observed by a representative of our firm to document pile depth, pile size, and installation torque.

All pile caps in non-climate-controlled portions of the structures should be placed at least 30-in. below final grade for frost protection.

Based on our experience, we believe this will be the most cost effective foundation solution as opposed to and earthwork solution requiring substantial import and export of unsuitable soils from the site. It is important to note that some removal and replacement of existing unsuitable Fill will be required regardless of the foundation system chosen for the project. We anticipate the majority of the removal and replacement will be associate with removal of unsuitable silt and clay from behind proposed basement walls, during floor slab subgrade preparation, and site improvements. Furthermore, if this option is chosen, the dewatering effort will likely be reduced when compared to an earthwork solution.

6.3 Ductile Iron Piles (Option 4)

Ductile Iron Micropiles (DIPs) are pre-fabricated driven piles utilizing high-strength ductile iron pipes manufactured with a centrifugal-casting process to deliver high impact resistance, ultimate strength and high elastic limit along with high corrosion resistance. DIPs can be installed very close to existing structures using an excavator-mounted hydraulic hammer fitted with a special drive adapter. Because these piles are installed using a high frequency hydraulic hammer, minimal vibration and lateral force is generated.

DIPs can be designed to resist loads through either end-bearing on competent soils/rock or frictional resistance within a grouted bond zone. Piles are installed by first inserting a flat or pointed driving shoe over the end of the hollow pile. The pile is then driven into the ground using high-frequency impact energy via a hydraulic hammer until the plug & drive socket end is nearly at the working grade. The driving resistance is observed during driving. Each pile segment is 5 meters in length. If the dense bearing material is not encountered within the first pile segment, the spigot end of the second DIP section is then inserted into the socket end of the existing initial pile section and the driving process is repeated. This process continues until the pile achieves a required driving criterion or bond length.

For this project, grouted end-bearing DIPs should be installed to penetrate Stratum A Fill soils and should terminate in the dense residual soils of Stratum B, disintegrated rock, or apparent bedrock. Although DIP design is performed by the Specialty Contractor, it is expected that a Series 98 or 118 pile could be designed using a 40 to 60-ton allowable compression capacity. **For budgeting purposes, DIP lengths of 30 feet could be assumed, however, additional deeper borings should be performed to confirm the depth of the proposed bearing stratum.** DIPs should be designed to limit total and differential settlement to the tolerances specified by the project structural engineer.

A static load test should be conducted on one DIP according to ASTM 1143-07, Procedure A. Upon completing the test, the pile must be overloaded to 300 percent of the design load or to failure in accordance with ASTM 1143-07, Procedure C. The installation criteria for production DIPs will be based on the results of the Static Load Test.

The Specialty Contractor should employ a QC program that is monitored full time. This QC program should ensure that production DIPs are constructed with consistent means and methods as the DIP tested in the load test. At a minimum, the QC program should include observation and testing of the load test DIP, measurement of installed pile lengths in the test and production DIPs, and monitoring of the termination criteria.

7.0 FLOOR SLAB RECOMMENDATIONS

The floor slab subgrades are expected to consist of compacted structural fill and soft existing Man-placed Fill soils. Prior to the placement of the floor slabs, the suitability of the slab subgrades should be determined by proofrolling. Proofrolling should be performed using a fully loaded 20-ton triaxle dump truck or equivalent under the observation of the Geotechnical Engineer of Record (GER). Any additional loose or unsuitable soils found during proofrolling should be removed and replaced with compacted fill as outlined in Section 5.

We do not believe that the site will pass a proofroll without select undercut and replacement. It is recommended that the owner or contractor carry an allowance for 2 foot of undercut, stabilization geotextiles, and replacement as needed to prepare a stable working grade.

It should be understood that allowing existing Man-placed Fill to remain below the floor slab carries the risk of undesirable settlement of the slab. Based on the conditions encountered in the test borings, we have assumed that the existing Man-placed Fill is relatively free of organics. Therefore, we have recommended proofrolling the building pad prior to the placement of the floor slab or any compacted structural fill necessary to bring the building pad up to grade and removing and replacing select areas of soft and unsuitable soils, as necessary. However, unless all existing Man-placed Fill is removed and replaced with new compacted structural fill, some risk will remain.

Floor slabs-on-grade are expected to be designed using a modulus of subgrade reaction, k equal to 125 pci. Groundwater is estimated to be greater than 5 feet below the proposed finished floor grades and a special under-floor subdrainage system is not considered necessary. A layer of drainage fill, consisting of a minimum of four inches of washed gravel or open graded crushed stone, should be placed below all floor slabs as a capillary break. If moisture sensitive flooring is installed, we recommend that a true vapor barrier such as a Stego wrap be placed between the concrete slab and the drainage fill.

On most projects, there exists a significant lag time between the initial grading and the placement of the floor slab. Environmental conditions and construction traffic often disturb the soil subgrade during this lag time. The contractor should make provisions in the construction specifications for the restoration of the subgrade to a stable condition prior to the placement of the floor slab at no additional cost to the owner.

8.0 DRAINAGE

Grades should be designed to provide positive drainage away from the proposed building addition and permanent site improvements, and any excavations throughout construction, and be maintained throughout the life of the building. Allowing water to pool near the perimeter of the building or on-site during construction or throughout the life of the structure may result in greater settlement than discussed in this report as well as decreased serviceability of the near-grade portions of the structures (e.g. slabs, foundations, pavements, pavers, etc.).

Landscape irrigation adjacent to the foundation systems should be minimized or eliminated. If landscaped areas are constructed within 10 feet of the foundation systems, the areas should be designed to have positive drainage away from the foundation, and this drainage should not be hindered by landscape edging, grade variations, or vegetation.

Upon completion of the building construction, we recommend that verification of final grading (as built) be performed to document that positive drainage, as described above, has been achieved.

9.0 BELOW-GRADE BASEMENT WALLS

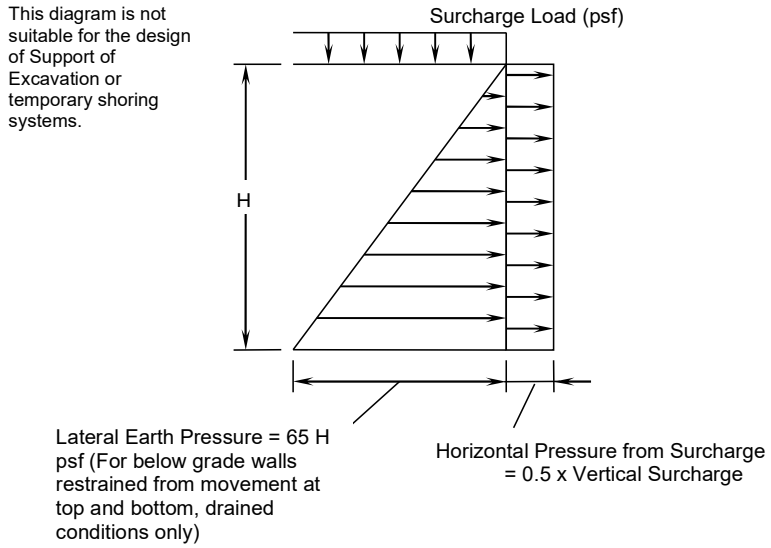
Based on our understanding of the proposed construction, below-grade basement walls are planned for the building addition. We recommend that below grade foundation walls be designed to withstand at-rest lateral earth pressures and surcharge loads from adjacent building foundations and slab loads. These recommendations apply to a “drained” condition which is where there is drainage material behind below grade walls that prevents hydrostatic water pressures on the back of the below grade wall.

To accomplish a drained condition, drainage materials such as free draining gravel, geocomposite drainage panels, perimeter drains, and weep holes should be used. Materials suitable for backfill of the below grade walls (beyond the drainage board) are soils classified as Silty Sand (SM) or more granular. The on-site soils encountered in the borings indicate suitable basement wall backfill will need to be imported for the project. Unsuitable CH and MH will need to be replaced with SM or more granular soils within the retained zone of the walls (i.e., 1H:1V from bottom of wall). In the design of the wall structures, the following soil parameters may be utilized (assuming level backfill conditions and SM or coarser soils are in the retained zone of the wall):

Recommended Below Grade Wall Design Parameters

Soil Parameter	Estimated Value
Soil Classification	Silty Sand or coarser
Coefficient of At Rest Earth Pressure (K_o)	0.50
Retained Soil Moist Unit Weight (γ)	130 pcf
Cohesion (c)	0 psf
Angle of Internal Friction (φ)	30°
Friction Coefficient [Concrete on Soil] (μ)	0.35
At-Rest Fluid Equivalent Earth Pressure	65 pcf

The following Figure depicts our recommended at-rest lateral earth pressure condition for a “drained below-grade wall” with a restrained wall top:



Lateral Earth Pressure Diagram

Surcharge loads imposed within a 45-degree slope from the base of the restrained wall should be considered in the below grade wall design. These surcharge loads should be based on an at-rest pressure coefficient, k_0, of 0.50. Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall; in addition, such loads are not typically considered in the design of below grade walls. All building walls should be braced prior to backfilling.

Please note that for below grade walls that cannot accommodate positive drainage, 62.4 psf should be added to the at rest equivalent earth pressure to account for an undrained. We anticipate this condition may be encountered in the elevator pit, stairwell, and potentially the new electrical room in the existing basement. All below grade walls should be waterproofed and should include a water stop at the slab/wall interface and in any construction/control joints in the proposed basement walls.

10.0 SITE RETAINING WALLS

Seat walls are planned to accommodate grade changes near the entry of the building situated in the southwestern portion of the site. Details of the proposed concrete seat walls were indicated on the 60% Design Development plan set and we understand the proposed walls will have an exposed height of less than 4 feet. Since details of the proposed retaining wall construction were available at the time of this report, we have provided recommendations for cantilevered concrete retaining walls.

10.1 Cantilevered Retaining Walls

Recommended parameters for cantilevered retaining wall design (i.e., masonry walls, cast-in-place concrete walls, etc.) are indicated in the table below. It is expected that active condition can be used if the walls are designed to be cantilevered. The ponding of precipitation behind the walls should be avoided during construction as the pressure diagrams included do not include hydrostatic pressure. A Factor of Safety of at least 1.5 should be used for evaluation of overturning and sliding of the walls using the parameters indicated. All walls below grade should be waterproofed and include a drainage layer, perimeter foundation drains and/or synthetic drainage panel to allow water against the wall to flow into a perimeter drain which may be daylighted or tied into the storm drain system or sump.

Specific material and compaction requirements for fill against walls below grade are included in Section 5.3, Compacted Structural Fill. Compacted fill behind and in front of the walls should be free of organics and rocks larger than three inches in diameter and should consist of soils classifying SM or coarser. Compaction equipment exceeding 3,000 pounds in dead weight should not be used within five feet of the walls in order to avoid overloading the walls. The following parameters are only applicable to site retaining walls.

Table 10-6.1.1: Recommended Parameters for Cantilevered Walls

Soil Property	Value
Equivalent Fluid Pressure - Active	43 psf/ft
Equivalent Fluid Pressure - At-Rest	65 psf/ft
Equivalent Fluid Pressure - Passive	250 psf/ft
Earth Pressure Coefficient - Active	0.33
Earth Pressure Coefficient – At-Rest	0.50
Coefficient of Friction at Base	0.35

Surcharge pressure should be added to the equivalent fluid pressures using the earth pressure coefficients for the appropriate loading case.

A design soil bearing pressure of 2,000 psf is recommended for cantilevered wall footings founded on suitable natural soils and/or newly compacted fill when installed as described herein. Some undercutting of the existing Till or lowering of retaining wall foundations may be required during retaining wall foundation construction due to the presence of existing Man-Placed Fill. The extent of Man-Placed Fill is unknown due to the scope of the exploration.

10.2 Waterproofing and Drainage of Permanent Below-Grade Walls

Waterproofing and foundation drains will be required. A 6-inch perforated drain encompassed in a suitable separation geotextile should be installed along the backside of all foundations and basement walls. The backside of the proposed foundation walls or basement walls should have a 12-inch-thick drainage layer consisting of open graded natural stone (i.e., #57 stone). The foundation drainage system should be coordinated with the Civil Engineer to ensure that the drainage system positively drains to an approved outfall. Waterproofing is recommended behind all basement walls and water stop is also recommended between the wall and slab joint at the basement foundation level and in any joints in the basement walls. In lieu of a drainage layer, a drainage mat could be substituted.

10.3 Underpinning – Sequenced Concrete Trenches

We understand that the excavations planned at the proposed building tie-in is planned to encroach on existing shallow foundations of the existing library. We understand that sequence concrete trenching is planned. The planned underpinning approach appears to be feasible, however, as previously mentioned we were unable to complete the test pit scope for this exploration due to utility conflicts. It is important that D.W. Kozera prepare a scope to complete the work to verify the depth and dimensions of the existing foundations for planning and designing the underpinning. This work could be done right before construction with the aid of the selected contractor. Although we did not complete the test pit scope, the borings indicate an allowable bearing capacity of 2,000 psf could be used to design the underpinning foundations, provided the trenches extend into compact Residual soils of Stratum B. If encountered, the bearing elevations of the concrete trenches should be lowered to penetrate the Man-Placed fill of Stratum A. Bracing of the existing masonry walls in the area of underpinning should be included and the contractor should strictly follow the planned excavation sequence, and maximum excavation lengths as noted by the underpinning design engineer.

Design of the underpinning system should be performed by a specialty contractor, with at least five years of experience in the performance of the specialized work. The drawings and design calculations should be prepared by a registered professional engineer in the State of Maryland and submitted to our office for review. D.W. Kozera should be contracted to observe the underpinning to confirm the bearing conditions prior to placing concrete.

11.0 STORMWATER MANAGEMENT CONSIDERATIONS

Based on the provided Civil plans and requested SWM scope, we understand that one SWM device is planned for the development. MK Consulting requested one SWM boring and infiltration test for the proposed SWM facility at a test elevation of EL 396.62. Based on the borings performed and infiltration results, infiltration practices are not considered feasible. A design groundwater elevation of EL 400± should be used for designing the SWM facility.

11.1 Stormwater Management Infiltration Recommendations

The Stormwater Management Administration of the Maryland Department of the Environment (MDE) has set particular standards and specifications for the design and construction of stormwater infiltration devices. These regulations include parameters on soil textures, depth of limiting zone, and other considerations described in the publication “Maryland Stormwater Design Manual, 2000.”

Appendix D.1 of the MDE manual describes geotechnical testing requirements prior to the final design of a stormwater management facility. The manual requires *initial feasibility testing* to determine the likelihood of using infiltration characteristics for stormwater management. If infiltration appears feasible based on the initial testing, then *concept design testing* is required to approximate actual infiltration rates.

The MDE publication recommends that a four-foot distance be provided between the bottom of the infiltration system and any limiting zones. Limiting zones are defined as a seasonal high-water table, fine-grained soils, and/or bedrock. Founding of infiltration facilities within existing fill soils is also prohibited, in accordance with the publication.

Based on the borings performed, the presence of existing Fill soils, depth at which groundwater was encountered, and the presence of limiting layers of fine-grained silts and clays present at or near the proposed SWM facility location, we do not recommend infiltration practices as the elevations evaluated as part of this investigation. Furthermore, the infiltration test did not sufficiently infiltrate after pre-soaking for the test, therefore, infiltration practices are not recommended. We recommend the facility have underdrains and be lined with a PVC liner to reduce any infiltration into the underlying highly plastic clays and silts.

12.0 CONSTRUCTION CONSIDERATIONS

Specific recommendations for foundation construction are given below:

12.1 Earthwork

The work areas should be stripped of existing topsoil and soft surface soils, and the resulting subgrades proofrolled under the observation of our representative. Any soft or unsuitable soils encountered should be removed and replaced with compacted fill. Abandoned underground utilities must be removed and replaced with compacted structural fill. Where excavations made for utility abandonment, demolition, or new utility installation trenches will intersect new footing subgrades, the excavation shall be replaced with lean concrete or compacted structural fill. The GER should be scheduled to observe the placement of all structural fill and bearing subgrades.

12.2 Groundwater

Groundwater was encountered within or near the excavation depths anticipated for the proposed construction. In addition, perched water is expected to be encountered at Fill and natural soil interfaces, on layers of fine-grained, less permeable soils, utility trench bedding, and near existing drainage media.

Regardless of whether groundwater was encountered during the exploration, the contractor should make their own determination of the dewatering needs for the project. At a minimum, the contractor should plan to have sumps and pumps available to control groundwater encountered in excavations and to control surface runoff into excavations during construction to maintain dry excavations and to protect working grades. It is also important to note that seasonal variations can impact the groundwater throughout the year. **The soils encountered during this exploration indicate they will be highly moisture sensitive and will degrade if positive drainage and protection of subgrades is not maintained prior to, during, and after construction**.

12.3 Spread Foundations

Care should be exercised during the excavation for all footings to minimize disturbance of the footing and fill subgrades. If subgrades are disturbed, the subgrades should be lowered to undisturbed soils. Footings should be excavated and concreted the same day to avoid ponding of surface runoff water in footing excavations and to avoid other disturbances such as freezing, extreme moisture variations (wetting or drying), etc. A mud mat consisting of a minimum of two inches of lean concrete may be placed to preserve the subgrades after the subgrade is approved by an engineer from our office. Hand cleaning of the disturbed soils left by the backhoe excavation will be required to produce a minimally disturbed subgrade. A flat-bladed excavation bucket will help to minimize the hand work.

12.4 Helical Piles

Helical Piles should be installed following the recommendations provided in Section 6 of this report.

Construction of Helical Piles should be performed under the full-time observation of a geotechnical engineer from our office. Quality control should include the monitoring of Installation torque and depth recorded during helical pile installation at 3-foot intervals, and recording of pile bearing elevations.

A load test should be performed in accordance with the recommendations provided in Section 6.3 of this Report. The load test should be performed under the full-time observation of a geotechnical engineer from our office.

The Specialty Contractor should provide any additional preparation requirements not listed in this report as part of their design submittal. D.W. Kozera should be retained to review plans, specifications, shop drawings, and submittals for these recommendations to be valid.

.

12.5 Pile Caps on DIPs

DIPs are deep foundation elements that should be embedded, and structurally connected into pile caps, grade beams, and any other structural foundation element. DIPs are typically embedded between 4 and 6 inches into pile caps unless greater embedment is required for pile fixity and lateral load resistance. The top of the pile shall include an oversized steel bearing plate to limit stresses in the pile cap. Bearing plate dimensions typically range between 8 to 12 inches in width and 0.75 to 1.5 inches in thickness and should be designed by the structural engineer. The bearing plates are typically held in place by inserting a short section of threaded bar into the wet grout on the interior of the pile to maintain the plate position.

The Specialty Contractor should provide any additional preparation requirements not listed in this report as part of their design submittal. D.W. Kozera should be retained to review plans, specifications, shop drawings, and submittals for these recommendations to be valid.

12.6 Compacted Structural Fill

Compacted fill should meet the requirements outlined in this report. All compacted structural fill and backfill for pavements, paver, slabs, site retaining walls, foundation walls, and basement walls should be compacted to 95 percent of the maximum dry density per ASTM D698, Standard Proctor. This may not apply to fill placed in public right of ways, therefore, fill placement in public right of ways should be in accordance with the authority having jurisdiction. It is recommended that earthwork be performed in the warmer, drier months between May and October.

12.7 Review of Construction Documents

Any deviation to the project design subsequent to the date of this report, such as changes in floor grades, building loads and building location, should be brought to our attention to determine if our recommendations contained herein remain valid. We should be allowed to review the project drawings and specifications, as a follow-up to our design recommendations and as a precursor to our providing the geotechnical engineering services during construction.

12.8 Construction Observation and Testing

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions will vary from those encountered in the test borings, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. D.W. Kozera, Inc. considers construction observation and testing of the foundations and earthwork an integral part of the geotechnical design, and therefore these services should be provided by the geotechnical engineer of record. As the actual subsurface conditions are exposed and observed by us during construction, modifications to our report recommendations can be made promptly and efficiently as needed. Note that we cannot assume liability or responsibility for the adequacy of our foundation recommendations if we do not observe the foundation construction.

Observations and testing should at minimum include full-time observations of the excavation of foundations, underpinning, foundation construction, basement wall construction, structural fill, excavations, subgrade preparation, slab subgrades, and field density testing of compacted structural fill. Other services, including materials testing (concrete, reinforcing steel, bituminous concrete, masonry, etc.) can be provided upon request if requested as part of the contract documents.

APPENDIX A

Subsurface Investigation Report

APPENDIX A

GENERAL NOTES FOR TEST BORINGS AND TEST PITS
Geotechnical Engineering Study, Forest Park Library
3023 Garrison Boulevard
(DWK Contract Number 22223.D)

1. Test Borings

Test borings are advanced by turning an auger with a center opening of 2-1/2 or 3-1/4 inches. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger by standard methods.

1.1. Standard Penetration Tests

Testing is performed by driving a two-inch O.D., 1-3/8-inch I.D. sampling spoon through three, six-inch intervals or as indicated, using a 140-pound hammer falling 30 inches according to ASTM D1586. The number given as the 'N' value is the sum of the blows required to drive the samples for the second and third intervals.

2. Test Pits

Test pits are logged to provide a record for geotechnical evaluation, construction inspection, or other specialized purposes such as building damage investigations, subgrade inspections, etc.

2.1. Test Procedures

PP, when indicated, denotes the results of tests performed with a Pocket Penetrometer. The numbers indicate the unconfined compressive strength of the undisturbed soils in tsf. DCP, when indicated, denotes the results of tests performed with a Dynamic Cone Penetrometer at an initial seating increment of two inches, and 1-3/4-inch increments thereafter. The penetrometer is driven by a 15-pound hammer falling 20 inches, and the number of hammer blows per increment is recorded.

3. General

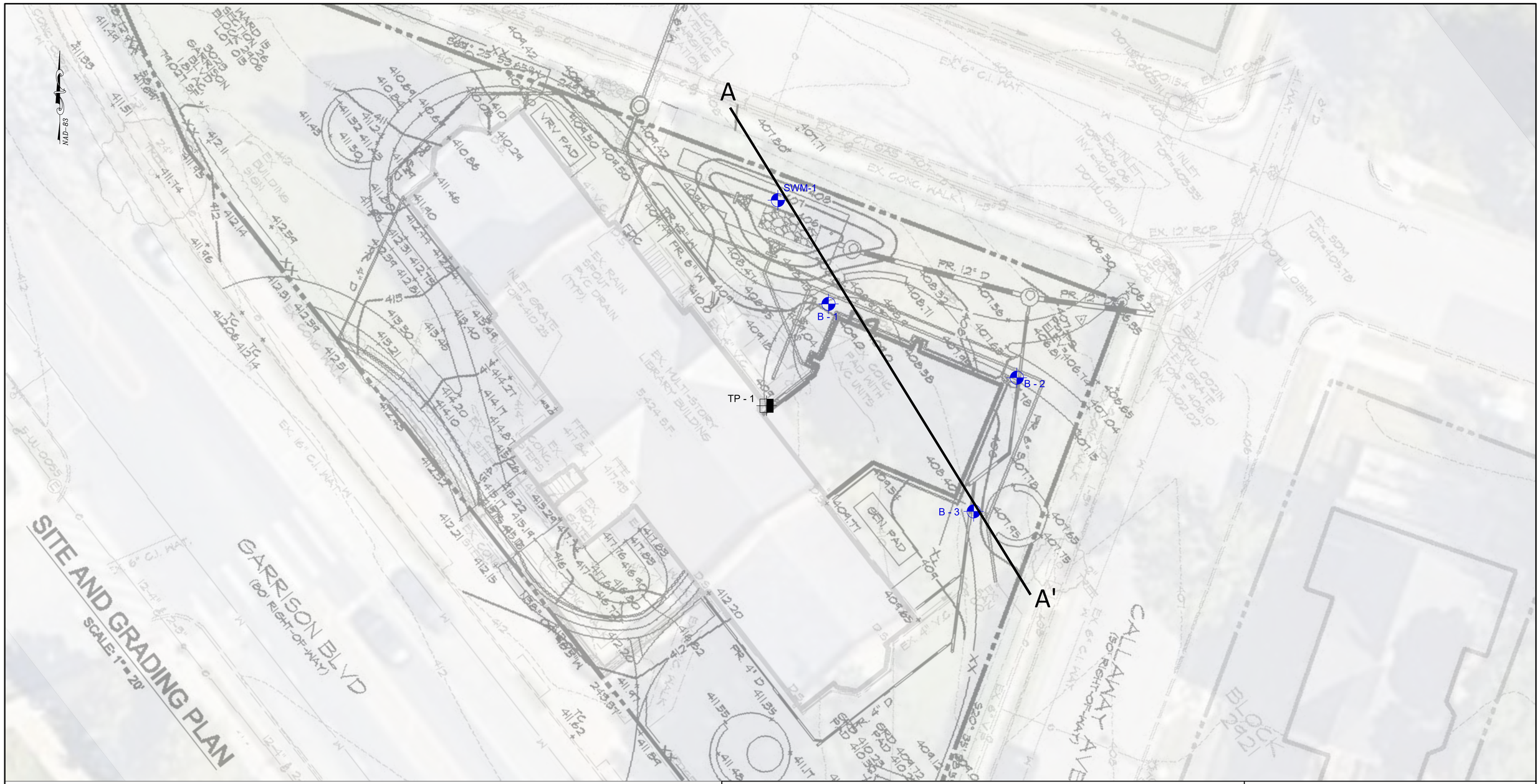
The test pits and test boring logs represent subsurface conditions only at the specified location and at the particular time excavated. The passage of time may result in changes in these conditions. Conditions at other locations on the site may differ from conditions occurring at the test pit or test boring location.

The stratification lines represent the approximate boundary line between soil and rock types as observed in the test pit and test boring. The soil profile, foundation dimensions, water level observations, and test results presented on the log have been made with reasonable care and accuracy but must be considered only an approximate representation of the subsurface conditions to be encountered at that particular location.

The observed water levels are considered a reliable indication of the groundwater table levels at the time indicated. The groundwater table may be completely dependent on the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation, construction activity, etc.

4. Locations and Grades

The test borings were located in the field by D.W. Kozera, Inc. based on drawings provided to us. The ground surface elevations were estimated from the drawings.



LEGEND:

DWK - # APPROXIMATE DWK TEST BORING LOCATION

TP - # APPROXIMATE DWK TEST PIT LOCATION

APPROXIMATE SUBSURFACE CROSS SECTION

10 0 10 20 30

Scale 1" = 10'

D.W. KOZERA, INC
PROFESSIONAL ENGINEERS AND GEOLOGISTS

EXPLORATION LOCATION DIAGRAM

PREPARED FOR:

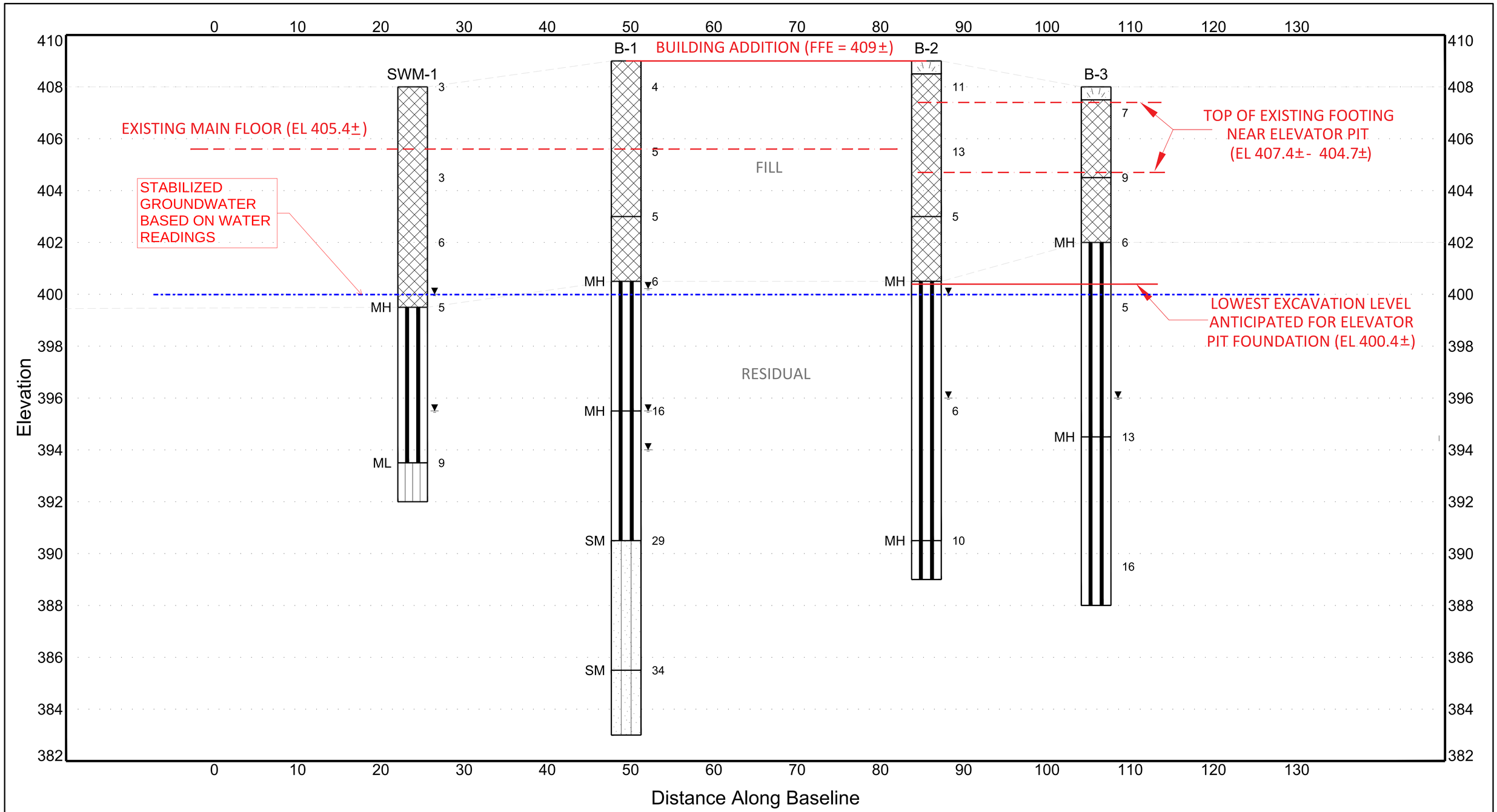
PENZA BAILEY, A STUDIO OF
PRIME AE GROUP, INC

PROJECT:

FOREST PARK LIBRARY
3023 GARRISON BOULEVARD
BALTIMORE, MARYLAND

DATE:	4/9/24
PROJECT:	22223.D
DRAWN BY:	C. GREEN
REVIEW BY:	J. LATHAM

SHEET
1 OF 1



NOTE: EXISTING AND PROPOSED ELEVATIONS FROM PLANS PROVIDED BY PRIME AE.

D.W. KOZERA, INC
PROFESSIONAL ENGINEERS AND GEOLOGISTS

SUBSURFACE PROFILES

PREPARED FOR:
PENZA BAILEY, A STUDIO OF PRIME AE GROUP, INC

PROJECT:
FOREST PARK LIBRARY
3023 GARRISON BOULEVARD
BALTIMORE, MARYLAND

DATE:	4/24/24
PROJECT:	22223.D
DRAWN BY:	C.GREEN
REVIEW BY:	J. LATHAM

SHEET 1 OF 1

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B-1
Contract No.: 22223.D
Page: 1 of 1

Project: Forest Park Library
Location: 3023 Garrison Blvd
Baltimore, MD

Ground Surf. El. (±)	: 409.0
Date Started	: 4-1-24
Date Completed	: 4-1-24
Contractor	: Free State Drilling
Driller	: Joe
Rig	: Acker
Drill Method	: HSA
Inspector	: C. Green

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	4-1	09:22	13.5	13.5	---
Completion	4-1	10:00	---	26.0	---
Casing Pulled	4-1	10:05	15.0	---	---
24-Hr Reading	4-2	17:20	5.1	---	---
	5-3	13:45	8.8	---	15.8

Depth (ft)	Surf. Elev. 409.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								6" Top soil			Rained during drilling
		1	WOH-2-2	4				FILL, sandy silt, trace roots and gravel, moist, orangish brown		A	PP= 0.75 tsf
	405	2	2-2-3	5					FILL		PP= 1 tsf
5		3	3-3-2	5				FILL, sandy fat clay, moist, yellow and brown			
	400	4	3-3-3	6	▼		MH	SANDY ELASTIC SILT, moist, yellow and tan		B	
10											
	395	5	3-5-11	16	▽		MH	SANDY ELASTIC SILT, trace rock fragments, wet, orange and brown	RESIDUAL		
15											
	390	6	7-11-18	29			SM	SILTY SAND, trace rock fragments, moist, gray and brown			
20											
	385	7	5-11-23	34			SM	SILTY SAND, moist, gray			
25		8	50/0	50/0				Auger and SPT Refusal at 26 feet			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B-2
Contract No.: 22223.D
Page: 1 of 1

Project: Forest Park Library
Location: 3023 Garrison Blvd
Baltimore, MD

Ground Surf. El. (±)	: 409.0
Date Started	: 4-1-24
Date Completed	: 4-1-24
Contractor	: Free State Drilling
Driller	: Joe
Rig	: Acker
Drill Method	: HSA
Inspector	: B. Desilva

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	4-1	10:33	13.0	13.0	---
Completion	4-1	10:39	---	18.5	---
Casing Pulled	4-1	10:45	9.0	---	13.1
24-Hr Reading	4-1	11:00	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 409.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								6" Top soil			Rained during drilling
		1	3-5-6	11				FILL, sandy lean clay, trace gravel and roots, wet, brown and tan		A	
	405	2	2-5-8	13					FILL		PP=2 tsf
5		3	3-2-3	5				FILL, sandy elastic slit, wet, yellow and brown			PP=0.75 tsf
	400							SANDY ELASTIC SILT, wet, grey green and white		B	
10					▽						
	395	4	6-3-3	6			MH		RESIDUAL		
15											
	390	5	3-5-5	10			MH	SANDY ELASTIC SILT, wet, grey and white			
20								End of Test Boring at 20 feet			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B-3
Contract No.: 22223.D
Page: 1 of 1

Project: Forest Park Library
Location: 3023 Garrison Blvd
Baltimore, MD

Ground Surf. El. (±)	: 408.0
Date Started	: 4-1-24
Date Completed	: 4-1-24
Contractor	: Free State Drilling
Driller	: Joe
Rig	: Acker
Drill Method	: HSA
Inspector	: B. Desilva

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	4-1	11:05	12.0	12.0	---
Completion	4-1	11:13	12.0	20.0	---
Casing Pulled	4-1	11:26	12.0	---	13.8
24-Hr Reading	4-2	17:20	3.5	---	7.0
	5-3	14:45	Dry	---	7.0

Depth (ft)	Surf. Elev. 408.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								6.5" Top soil			Rained during drilling
		1	3-3-4	7				FILL, sandy fat clay, trace rubble, trace to few roots, moist, brown		A	PP=2.5 tsf
	405								FILL		
		2	6-6-3	9				FILL, sandy lean clay, trace to few rubble, wet, red and brown			PP= 1.25 tsf
5											
		3	2-3-3	6				SANDY ELASTIC SILT, wet, red and white		B	
	400										
		4	3-3-2	5			MH				
10					▽						
	395								RESIDUAL		
		5	4-6-7	13				SANDY ELASTIC SILT, wet, grey and white			
15							MH				
	390										
		6	9-9-7	16							
20								End of Test Boring at 20 feet			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: SWM-1
Contract No.: 22223.D
Page: 1 of 1

Project: Forest Park Library
Location: 3023 Garrison Blvd
Baltimore, MD

Ground Surf. El. (±)	: 408.0
Date Started	: 4-1-24
Date Completed	: 4-1-24
Contractor	: Free State Drilling
Driller	: Joe
Rig	: Acker
Drill Method	: HSA
Inspector	: C. Green

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	4-1	08:25	---	---	---
Completion	4-1	08:30	---	14.5	---
Casing Pulled	4-1	08:41	12.5	---	13.0
24-Hr Reading	4-2	17:20	4.6	---	---
	5-3	13:00	8.0	---	8.3

Depth (ft)	Surf. Elev. 408.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0		1	1-1-2	3				6" Top soil FILL, sandy fat clay, trace roots, moist, orange and brown	FILL	A	Rained during drilling
	405	2	1-1-2	3							PP=0.75 tsf
5		3	2-2-4	6	▼						
	400	4	2-2-3	5			MH	SANDY ELASTIC SILT, moist, orangish brown and yellowish white	RESIDUAL	B	
10											
	395										
15		5	2-4-5	9			ML	SANDY SILT, moist, orangish brown and yellowish white			
								End of Test Boring at 16 feet			

APPENDIX B

Soil Laboratory Test Results

Forest Park Library

Project Number: 22223.D

Location: 3023 Garrison Blvd, Baltimore, MD

Sample Date:

Jay Kay Testing
(814) 404-9283
www.jaykaytesting.com

Summary of Laboratory Testing

Sample Identification		Depth				Atterberg Limits				Compaction					
Boring ID	Sample ID	Top, ft	Bottom, ft	NMC, % (ASTM D-2216)	Organic Matter, % (ASTM D-2974-C)	Liquid Limit, % (ASTM D-4318)	Plastic Limit, % (ASTM D-4318)	Plasticity Index, % (ASTM D-4318)	Specific Gravity (ASTM D-854)	Maximum Dry Density, lb/ft³	Optimum Moisture Content, %	AASHTO Classification (M-145)	% < 0.002 mm	% Fines	USCS Classification (ASTM D-2487)
B-1	S-1	1	2.5	32.3	-	-	-	-	-	-	-	-	-	-	-
B-1	S-2	3.5	5	32.5	-	49	28	21	-	-	-	A-7-6	-	86.6	ML
B-1	S-3	6	7.5	52.8	-	-	-	-	-	-	-	-	-	-	-
B-1	S-5	13.5	15	61.5	-	62	52	10	-	-	-	A-5	-	91.3	MH
B-2	S-1	1	2.5	27.8	-	38	22	16	-	-	-	A-6	-	91.7	CL
B-2	S-2	3.5	5	29.7	-	-	-	-	-	-	-	-	-	-	-
B-2	S-3	6	7.5	60.6	-	-	-	-	-	-	-	-	-	-	-
B-3	S-1	1	2.5	28.3	-	-	-	-	-	-	-	-	-	-	-
B-3	S-2	3.5	5	29.5	-	48	27	21	-	-	-	A-7-6	-	70.7	CL
B-3	S-3	6	7.5	59.4	-	-	-	-	-	-	-	-	-	-	-
B-3	S-4	8.5	10	73.8	-	96	45	51	-	-	-	A-7-5	-	98.7	MH
SWM-1	S-1	1	2.5	29.5	-	-	-	-	-	-	-	-	-	-	-
SWM-1	S-2	3.5	5	29.4	-	-	-	-	-	-	-	-	-	-	-
SWM-1	S-3	6	7.5	45.5	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-

Forest Park Library

Project Number: 22223.D

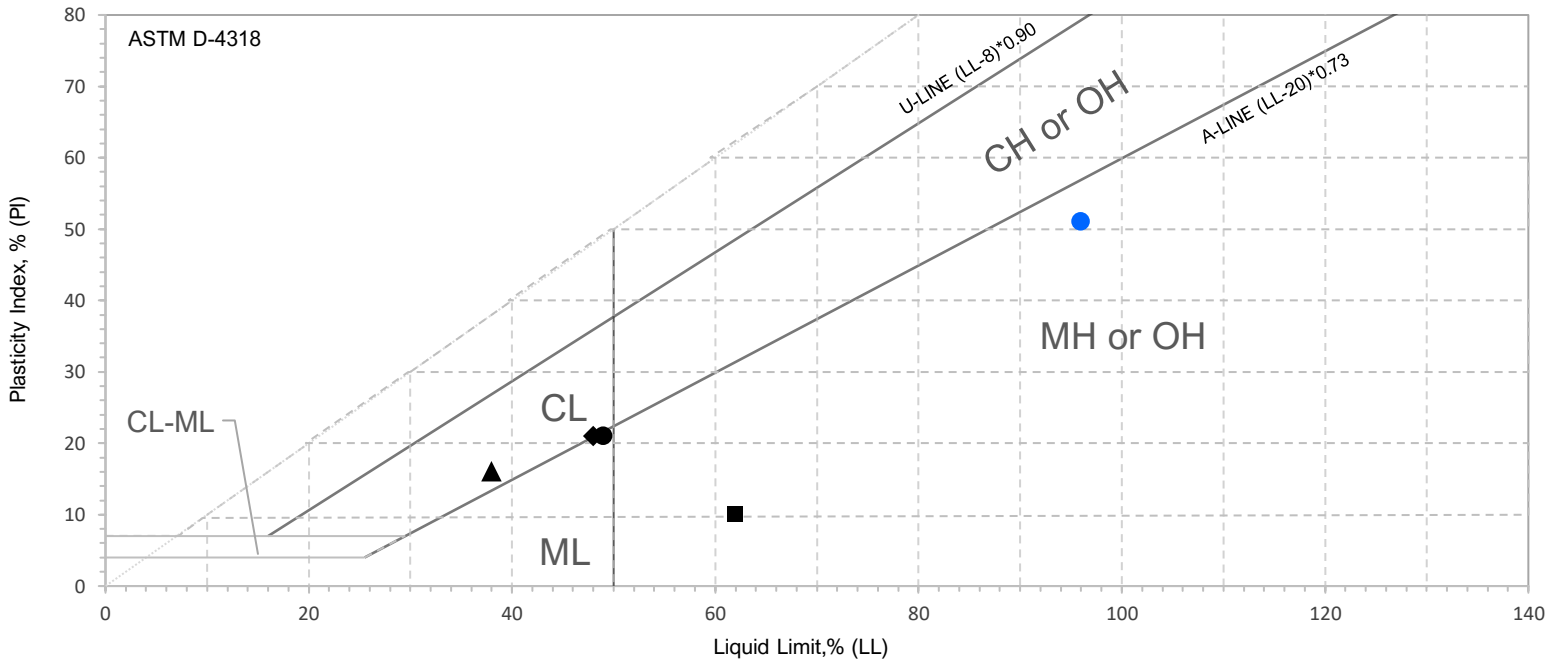
Location: 3023 Garrison Blvd, Baltimore, MD

Sample Date: 10/25/25

Jay Kay Testing
(814) 404-9283
www.jaykaytesting.com

Summary of Atterberg Limit Testing

Atterberg Limit Results



	Boring ID	Sample ID	Top	Btm	LL	PL	PI		Boring ID	Sample ID	Top	Btm	LL	PL	PI
●	B-1	S-2	3.5	5	49	28	21								
■	B-1	S-5	13.5	15	62	52	10								
▲	B-2	S-1	1	2.5	38	22	16								
◆	B-3	S-2	3.5	5	48	27	21								
●	B-3	S-4	8.5	10	96	45	51								

Forest Park Library

Project Number: 22223.D

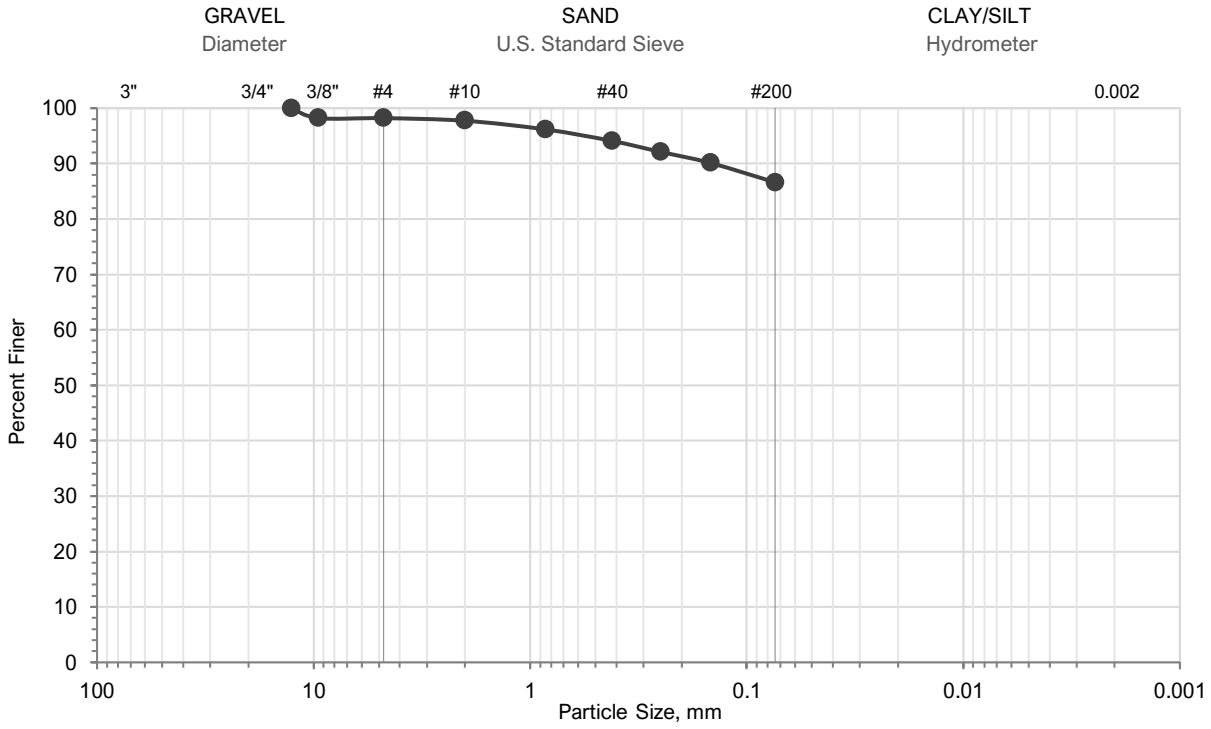
Jay Kay Testing

Boring ID	Sample ID	Top	Btm
B-1	S-2	3.5'	5'

Location: 3023 Garrison Blvd, Baltimore, MD

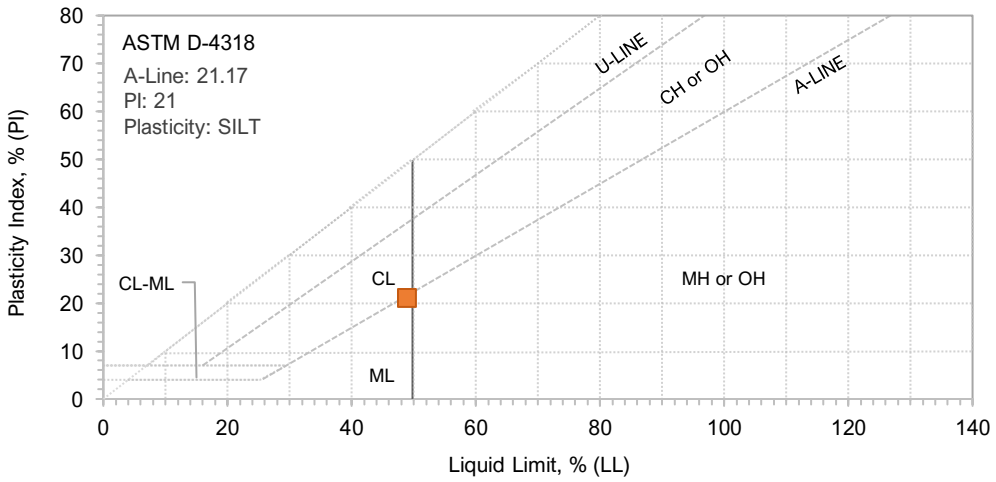
Sample Date: -

ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	100.0
3/8"	9.51	98.2
#4	4.75	98.2
#10	2.00	97.7
#20	0.85	96.2
#40	0.42	94.1
#60	0.25	92.1
#100	0.147	90.1
#200	0.074	86.6

% Gravel				% Sand				D10	-		
Coarse	Fine		Total	Coarse	Medium	Fine	Total	D30	-	CC	-
0.0	1.8	=	1.8	0.5	3.6	7.5	= 11.6	D60	-	CU	-



Liquid Limit, %	49
Plastic Limit, %	28
Plasticity Index, %	21

USCS (D-2487)	AASHTO (M-145)
ML	A-7-6

Soil Description (D-2487)

Brown SILT

NMC	32.5%	Sample Type*	-	Data 4	-
OM	-	Data 2	-	Data 5	-
		Data 3	-	Data 6	-
+ 3/8"	1.8%				

04/08/24 Tested by: ST/JT Reviewed by: JL Jay Kay Testing

Forest Park Library

Project Number: 22223.D

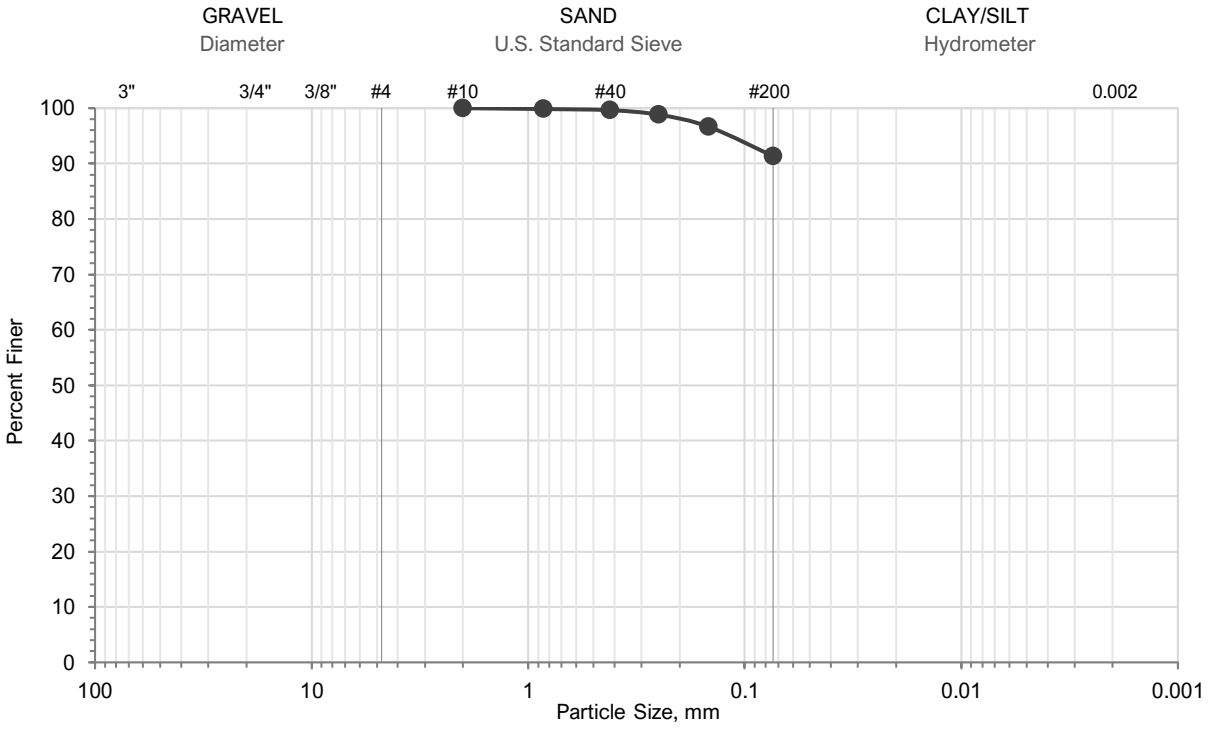
Jay Kay Testing

Boring ID	Sample ID	Top	Btm
B-1	S-5	13.5'	15'

Location: 3023 Garrison Blvd, Baltimore, MD

Sample Date: -

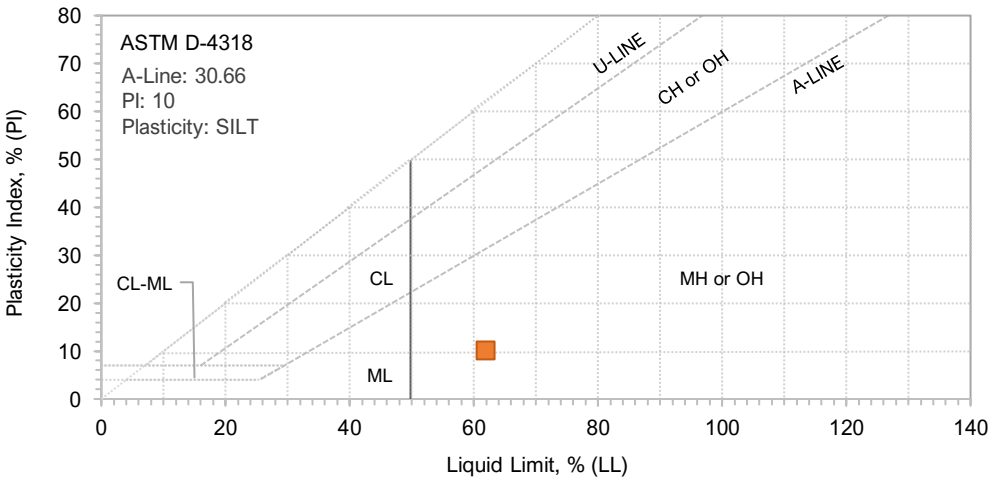
ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	-
3/8"	9.51	-
#4	4.75	-
#10	2.00	100.0
#20	0.85	99.8
#40	0.42	99.6
#60	0.25	98.8
#100	0.147	96.7
#200	0.074	91.3

% Gravel			% Sand				
Coarse	Fine	Total	Coarse	Medium	Fine	Total
0.0	0.0 =	0.0	0.0	0.4	8.3 =	8.7

D10	-		
D30	-	CC	-
D60	-	CU	-



Liquid Limit, %	62
Plastic Limit, %	52
Plasticity Index, %	10

USCS (D-2487)	AASHTO (M-145)
MH	A-5

Soil Description (D-2487)

Brown elastic SILT

NMC	61.5%	Sample Type*	-	Data 4	-
OM	-	Data 2	-	Data 5	-
		Data 3	-	Data 6	-
+ 3/8"	0.0%				

Forest Park Library

Project Number: 22223.D

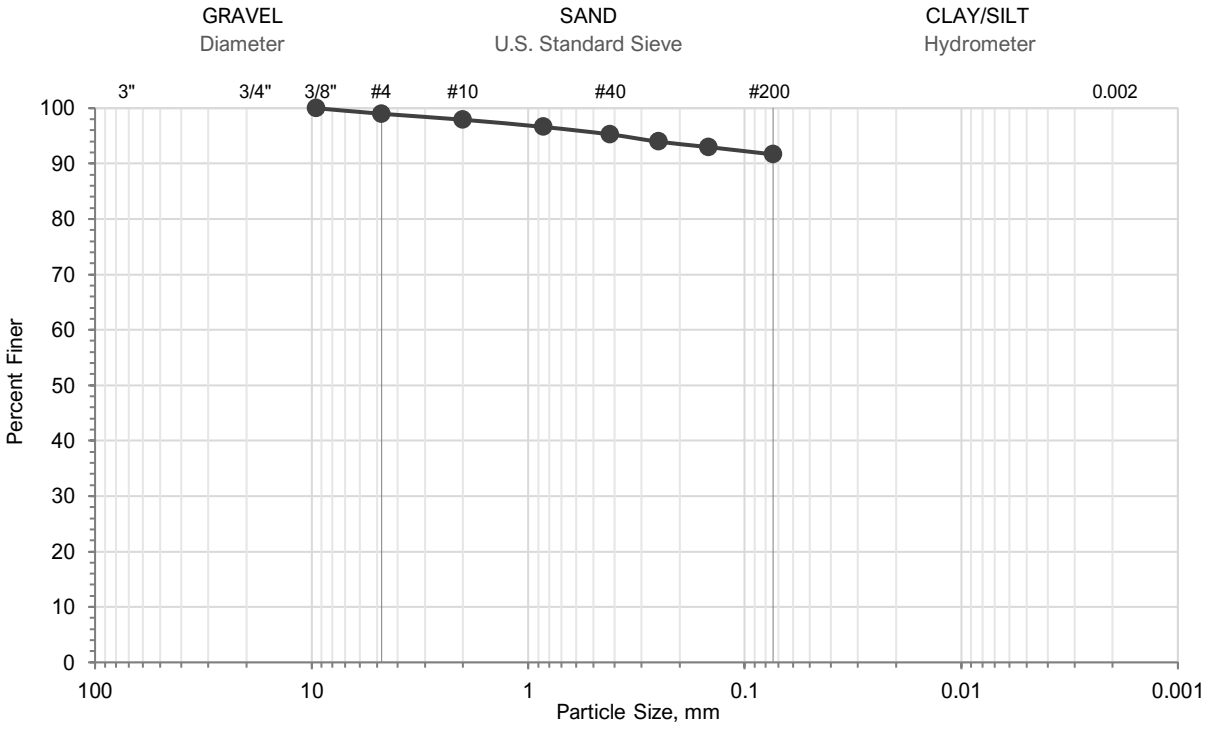
Jay Kay Testing

Boring ID	Sample ID	Top	Btm
B-2	S-1	1'	2.5'

Location: 3023 Garrison Blvd, Baltimore, MD

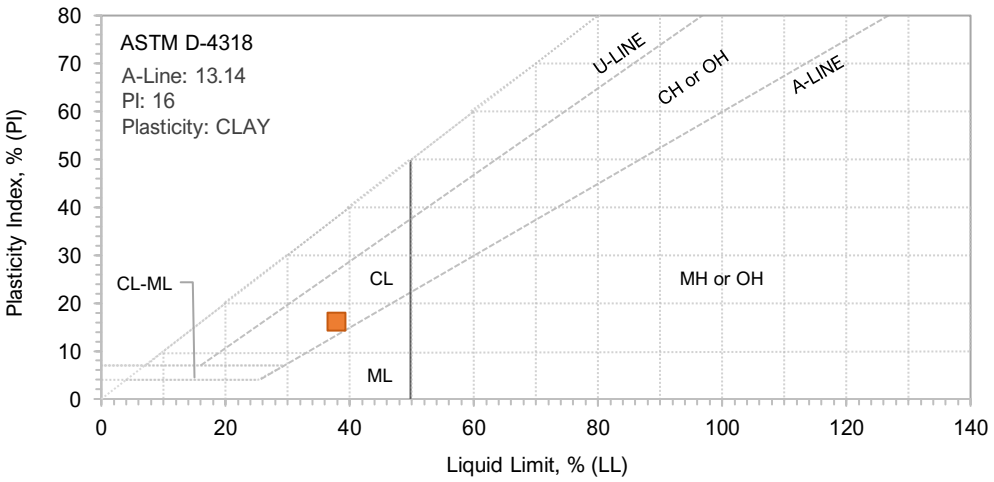
Sample Date: -

ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	-
3/8"	9.51	100.0
#4	4.75	99.0
#10	2.00	97.9
#20	0.85	96.6
#40	0.42	95.3
#60	0.25	94.0
#100	0.147	93.0
#200	0.074	91.7

% Gravel				% Sand				D10	-		
Coarse	Fine		Total	Coarse	Medium	Fine	Total	D30	-	CC	-
0.0	1.0	=	1.0	1.1	2.6	3.6	= 7.3	D60	-	CU	-



Liquid Limit, %	38
Plastic Limit, %	22
Plasticity Index, %	16

USCS (D-2487)	AASHTO (M-145)
CL	A-6

Soil Description (D-2487)

Brown lean CLAY

NMC	27.8%	Sample Type*	-	Data 4	-
OM	-	Data 2	-	Data 5	-
		Data 3	-	Data 6	-
+ 3/8"	0.0%				

Forest Park Library

Project Number: 22223.D

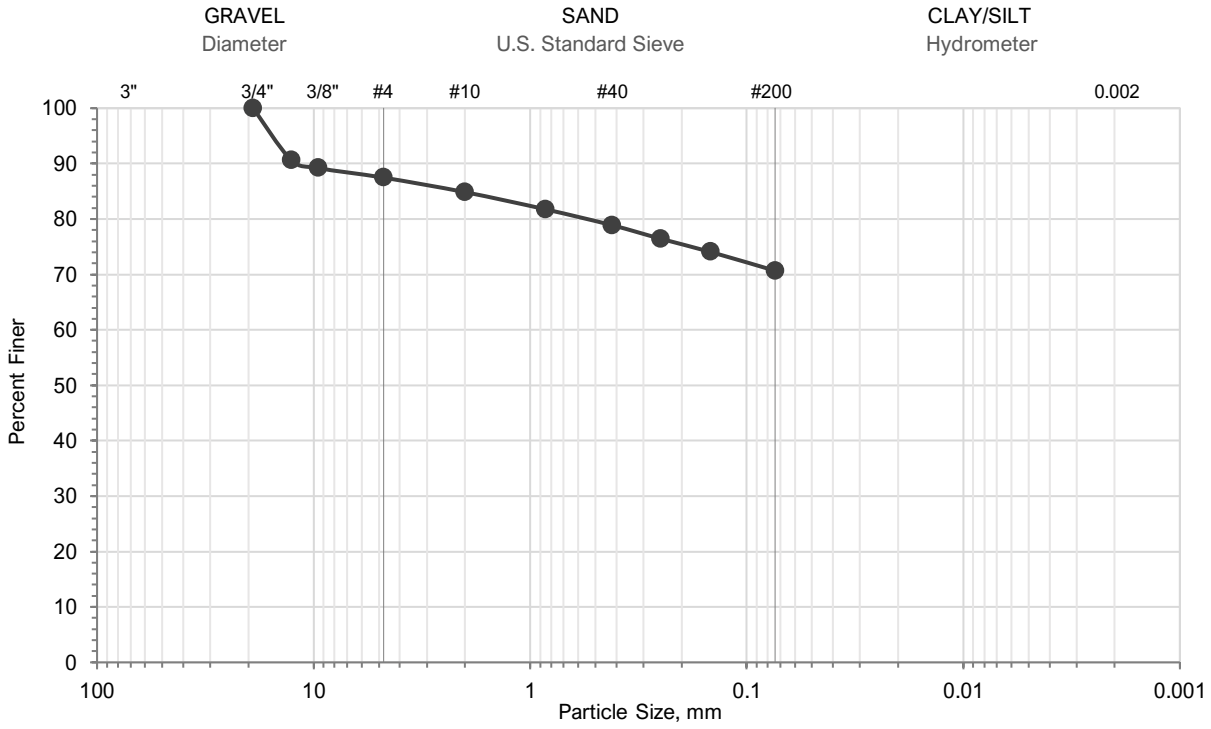
Jay Kay Testing

Boring ID	Sample ID	Top	Btm
B-3	S-2	3.5'	5'

Location: 3023 Garrison Blvd, Baltimore, MD

Sample Date: -

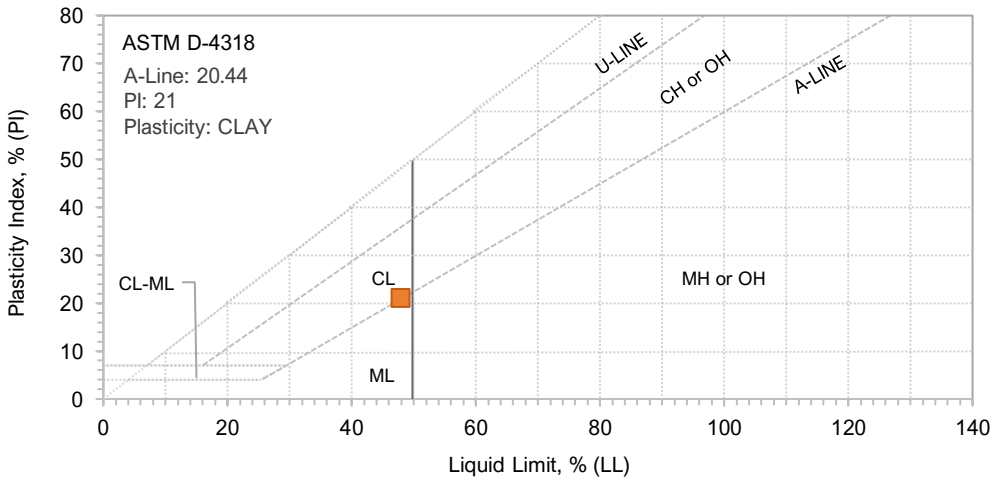
ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	100.0
1/2"	12.7	90.7
3/8"	9.51	89.2
#4	4.75	87.5
#10	2.00	84.8
#20	0.85	81.8
#40	0.42	78.9
#60	0.25	76.4
#100	0.147	74.1
#200	0.074	70.7

% Gravel				% Sand				
Coarse	Fine		Total	Coarse	Medium	Fine		Total
0.0	12.5	=	12.5	2.7	5.9	8.2	=	16.8

D10	-		
D30	-	CC	-
D60	-	CU	-



Liquid Limit, %	48
Plastic Limit, %	27
Plasticity Index, %	21

USCS (D-2487)	AASHTO (M-145)
CL	A-7-6

Soil Description (D-2487)

Brown lean CLAY with sand

NMC	29.5%		Sample Type*	-	Data 4	-
OM	-		Data 2	-	Data 5	-
			Data 3	-	Data 6	-
+ 3/8"	10.8%					

04/08/24 Tested by: ST/JT Reviewed by: JL Jay Kay Testing

Forest Park Library

Project Number: 22223.D

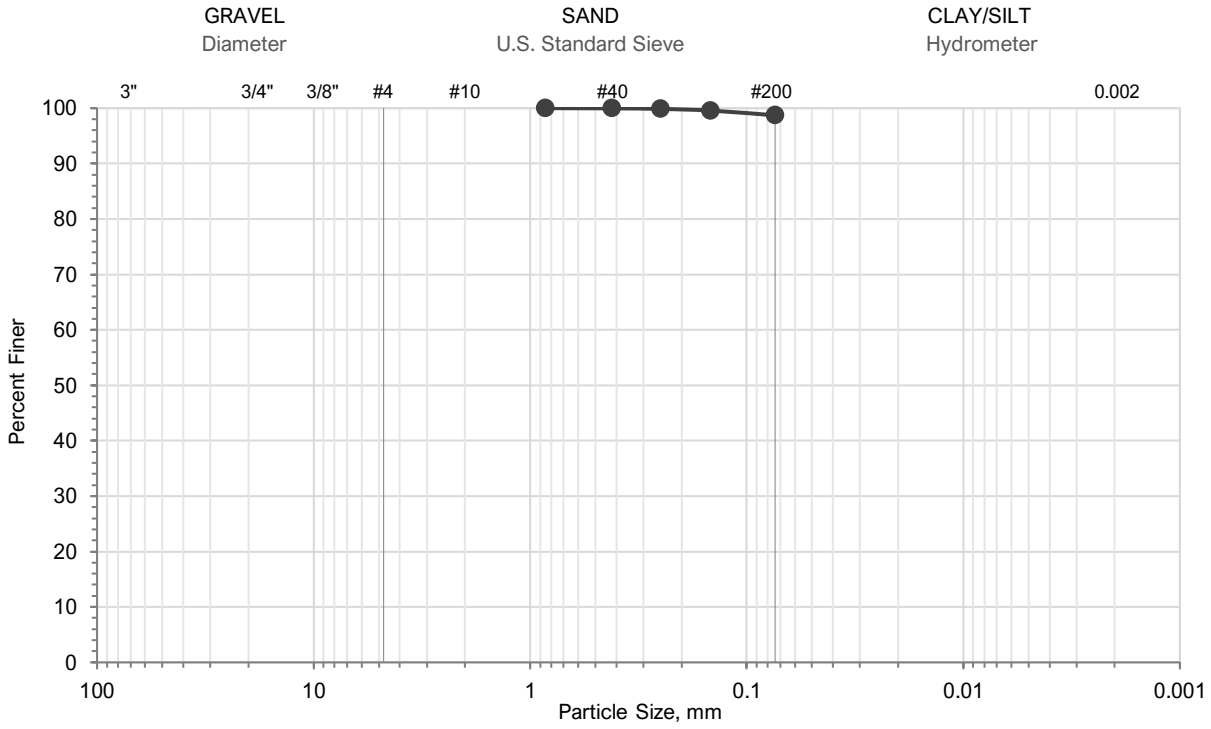
Jay Kay Testing

Boring ID	Sample ID	Top	Btm
B-3	S-4	8.5'	10'

Location: 3023 Garrison Blvd, Baltimore, MD

Sample Date: -

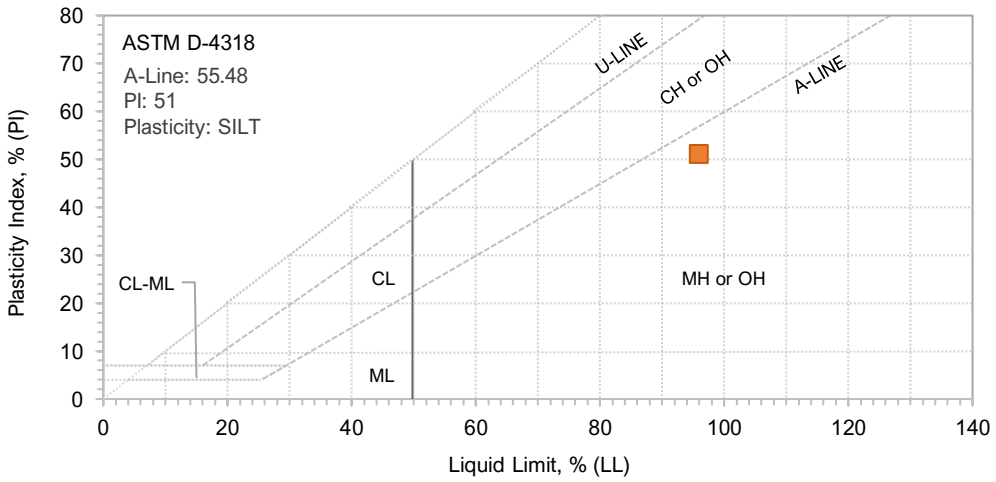
ASTM D-6913



Sieve	Size	Pass, %
-	mm	%
6"	150.0	-
3"	75.0	-
2"	50.8	-
1.5"	37.5	-
1"	25.4	-
3/4"	19.0	-
1/2"	12.7	-
3/8"	9.51	-
#4	4.75	-
#10	2.00	-
#20	0.85	100.0
#40	0.42	99.9
#60	0.25	99.9
#100	0.147	99.6
#200	0.074	98.7

% Gravel			% Sand				
Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	= 0.0	0.0	0.1	1.2	= 1.3	

D10	-		
D30	-	CC	-
D60	-	CU	-



Liquid Limit, %	96
Plastic Limit, %	45
Plasticity Index, %	51

USCS (D-2487)	AASHTO (M-145)
MH	A-7-5

Soil Description (D-2487)

Orange-brown elastic SILT

NMC	73.8%	Sample Type*	-	Data 4	-
OM	-	Data 2	-	Data 5	-
		Data 3	-	Data 6	-
+ 3/8"	0.0%				

EXHIBIT TWO

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Suspected Hazardous and Regulated Materials Observed and Asbestos Sampling Report
for
Enoch Pratt Free Library
Forest Park Branch
3023 Garrison Boulevard
Baltimore, MD

PREPARED FOR:

PRIME AE Group, Inc.
5521 Research Park Drive, Suite 300
Baltimore, MD 21228

Prepared by:

Aria Environmental, Inc.
PO Box 286
Woodbine, MD 21797

JUNE 2024

241467

Suspected Hazardous and Regulated Materials Observed and Asbestos Sampling Report
for
Enoch Pratt Free Library
Forest Park Branch
3023 Garrison Boulevard
Baltimore, MD

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Tables

Table 1 – Asbestos Bulk Sampling Results for Enoch Free Library, Forest Park Branch, Baltimore, Maryland, May 30, 2024

Attachments

Attachment A: Inspector's Credentials
Attachment B: Asbestos Certificates of Analysis and Chain-of-Custody Forms
Attachment C: Sample Location Plan

HAZARDOUS MATERIALS SURVEY REPORT FOR ENOCH PRATT FREE LIBARARY, FOREST PARK BRANCH, BALTIMORE, MARYLAND

I. EXECUTIVE SUMMARY

Aria Environmental, Inc. (AE) was contracted by PRIME AE Group in 2020 to perform a visual hazardous materials survey of the Forest Park Branch located at 3023 Garrison Boulevard in Baltimore, Maryland. The purpose of the purpose of the initial visual survey was to identify and characterize suspect hazardous or regulated building materials that may require further investigation prior to demolition or renovation.

The Forest Park Branch of the ENOCH Pratt Free Library was built in 1910. In April of 1964, two new wings were added to the library, nearly doubling its size. The library was rededicated in February of 1987 after another major renovation project. The library served the local neighborhoods of Baltimore. It is currently closed for renovations.

Observed building finish materials in the library included: plaster walls, drywall, joint compound, various colors of 12"x12" and 9"x9" floor tiles, and mastic, carpeting, decorative plaster cornices, aluminum windows, wood doors and drop ceiling tiles.

AE performed a visual inspection in January of 2020 to identify suspected hazardous and regulated materials that may be present in the building that would require further testing and inspection, special handling and disposal in the event of building renovation or demolition. Aria returned in May 2024 to perform an asbestos survey of suspect materials and to collect samples for analysis to identify asbestos containing materials the will require abatement prior to any renovations to the building.

The survey for hazardous materials at the Forest Park Library indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to demolition. Our recommendations are summarized below:

1. Remove and dispose of all asbestos-containing 9"x9" floor tiles identified at various locations throughout the lower level (staff area) of the library.
2. Remove and dispose of asbestos-containing black sink insulation identified in the kitchen/break room of the library.
3. Remove and dispose of all asbestos-containing black mastic identified in association of 12"x12" floor tile located throughout the lower level of the library.
4. Remove and dispose of asbestos-containing exterior window caulk from all windows.
5. Remove and dispose of asbestos-containing exterior vent caulk.
6. Remove and dispose of asbestos-containing exterior expansion joint mastic.
7. Remove and dispose of asbestos-containing exterior façade mastic.
8. Sample and analyze or remove mirror mastic as assumed asbestos containing materials.
9. Sample and analyze or remove roofing as assumed asbestos containing materials.
10. Sample and analyze or remove fire doors as assumed asbestos containing materials.
11. Remove and dispose of battery-containing lighted exit signs and emergency lights as universal waste.
12. Remove and dispose of oil-containing automatic door closers.
13. Inspect fluorescent lamp ballasts for a "no PCBs" label. Dispose of any that DO NOT have this label as PCB-containing waste.
14. Remove and dispose of fluorescent lamps, compact fluorescent bulbs and incandescent bulbs as universal waste.

15. Materials may be concealed behind solid walls, ceilings or in pipe chases. Demolition activities have the potential to expose additional asbestos-containing materials. Caution should be taken while demolishing solid ceilings and walls.
16. Lead-based paint was not surveyed but is expected to be present, due to the age of the facility. It is highly recommended that a full lead-based paint survey is performed. Any disturbance to painted surfaces that contain any detectable levels of lead should be performed in accordance with OSHA "Lead in Construction Rule (29 CFR 1926.62)" and the Lead Renovation, Repair and Painting Rule. Waste should be analyzed by toxicity characteristic leaching procedure (TCLP).

HAZARDOUS MATERIALS SURVEY REPORT FOR FOREST PARK BRANCH LIBRARY

II. INTRODUCTION

Aria Environmental, Inc. (AE) was contracted by PRIME AE Group in 2020 to perform a visual hazardous materials survey of the Forest Park Branch located at 3023 Garrison Boulevard in Baltimore, Maryland. The purpose of the purpose of the initial visual survey was to identify and characterize suspect hazardous or regulated building materials that may require further investigation prior to demolition or renovation.

The Forest Park Branch of the ENOCH Pratt Free Library was built in 1910. In April of 1964, two new wings were added to the library, nearly doubling its size. The library was rededicated in February of 1987 after another major renovation project. The library served the local neighborhoods of Baltimore. It is currently closed for renovations.

Observed building finish materials in the library included: plaster walls, drywall, joint compound, various colors of 12"x12" and 9"x9" floor tiles, and mastic, carpeting, decorative plaster cornices, aluminum windows, wood doors and drop ceiling tiles.

AE performed a visual inspection in January of 2020 to identify suspected hazardous and regulated materials that may be present in the building that would require further testing and inspection, special handling and disposal in the event of building renovation or demolition. Aria returned in May 2024 to perform an asbestos survey of suspect materials and to collect samples for analysis to identify asbestos containing materials the will require abatement prior to any renovations to the building.

Based upon the age of the original construction, as well as the additions, hazardous and regulated materials are expected to exist on the property. This report presents our methodologies; results of sampling and analysis activities; and our conclusions and recommendations for abatement. Copies of the inspectors' credentials are included as Attachment A.

III. METHODOLOGY

A. Asbestos

On May 30, 2024, representatives of AE conducted an asbestos survey of the interior and exterior of the Forest Park Branch Library, located at 3023 Garrison Boulevard in Baltimore, Maryland. A visual inspection for suspected asbestos-containing materials was performed followed by asbestos sample collection and laboratory analysis. Work was performed by Julia Fafard (Maryland Asbestos Inspector Management Planner No. MD-230004825, exp. 10/10/2024).

Bulk samples of each suspect asbestos-containing material encountered by the inspector were collected in randomly located areas. A clean sampling tool was used to obtain a "thumbnail" sized bulk sample. This sample was placed in a single-use 4-mil plastic bag, sealed and labeled. The sampling tool was cleaned with an amended water solution before and between uses. Samples were submitted to SEEML Labs of Greenville, SC (NIST-NVLAP Accreditation No. 201031-0) for analysis by Polarized Light Microscopy (PLM) using EPA method 600/R-93/116. A material is considered to be asbestos containing, if it contains one percent (1%) or more asbestos by PLM.

Suspect asbestos-containing materials were not sampled if they were located behind solid walls and ceilings, or in enclosed pipe chases that would have to be damaged to access the suspect building materials. Suspect asbestos-containing materials were also not sampled if there had been previous sampling to confirm a positive or negative result. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground, but is not likely.

B. Lead

A lead-based paint survey was not performed, however, based upon the age of the structure and the presence of interior and exterior painted wood, plaster and drywall surfaces, lead-paint is likely present. Furthermore, the building is considered a child occupied facility and will require compliance with the OSHA Lead in Construction Standard, Maryland Reduction of Lead Risk in Housing, and Lead Renovation Repair and Painting Rules.

MDE defines "*Lead-containing substance*" as "*any paint, plaster or other surface coating material containing more than 0.50 percent lead by weight calculated as lead metal in the dried solid, or more than 0.7 milligrams per square centimeter by the X-ray fluorescence analyzer*." [COMAR 26.02.07.02]. EPA states "*Lead-based paint is present:(i) On any surface that is tested and found to contain lead equal to or in excess of 1.0 milligrams per square centimeter or equal to or in excess of 0.5% by weight; and (ii) On any surface like a surface tested in the same room equivalent that has a similar painting history and that is found to be lead-based paint*." [Title 40 CFR 745.227(h)].

C. Polychlorinated Biphenyls

Polychlorinated biphenyls (PCB's) are a class of chemicals that were used in a wide variety of applications. PCBs are often found in dielectric fluids, cooling fluids, transformers, capacitors and caulks. PCB-containing equipment must often be disposed of as part of renovation and demolition projects. The EPA definition of PCB-containing materials is 50 parts per million (ppm) or milligrams per kilogram (mg/kg). A representative number of fluorescent light ballasts should inspected for the presence or absence of the "No PCBs" label. If the "No PCBs" label is absent, then the ballast is considered to contain PCBs. The number of ballasts was estimated based upon the type of light fixture observed in the building. Light ballasts were counted as follows: one ballast for every two four-foot fluorescent light tube observed in a multi-tube fixture and one ballast for every one four-foot or eight-foot fluorescent light tube observed in a single fluorescent light tube fixture that is not joined to a second light fixture with a shared ballast.

D. Mercury

Mercury within fluorescent lamps, thermostats, thermometers, and other mechanical equipment often must be disposed of during renovation and demolition activities. Each area Should surveyed for accurate counts of thermostats and/or equipment that may contain liquid mercury. Fluorescent light tubes may contain small amounts of mercury vapor and lead. Because disposal of fluorescent light tubes is regulated under the EPA Universal Waste rule, a count of fluorescent lamps should be identified.

E. Refrigerants

Refrigerant-containing equipment including refrigerators, freezers, and air conditioning units were identified for the purpose of recycling chlorofluorocarbon (CFC) and

hydrochlorofluorocarbon (HCFC) refrigerants that are known to deplete ozone. Under EPA's Refrigerant Recycling Rule, equipment that is typically dismantled on-site before disposal (e.g., retail food refrigeration, central residential air conditioning, chillers, and industrial process refrigeration) require refrigerant recovery.

IV. RESULTS

A. Asbestos

A visual inspection for suspected asbestos-containing materials was performed by AE. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground.

Representatives of AE conducted an asbestos survey of the interior and exterior of the Forest Park Branch Library in Baltimore, Maryland. Bulk samples of suspect asbestos-containing materials were collected by AE during the asbestos survey activities. Seventy-six (76) samples were collected and submitted for analysis by PLM. The lab split forty-three samples with distinct layers for a total of one hundred and forty-two (142) analyses. Twenty-one (21) of the one hundred and forty-two (142)samples analyzed were greater than 1% asbestos. Table 1 presents the samples and results. The chain of custody and certificates of analysis are located in Attachment B. A plan showing sample locations is included in Attachment C.

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-01	Yellow Carpet Glue	Main Room	NAD
FPB-02	Yellow Carpet Glue	Main Room	NAD
FPB-03A	Plaster-White Skim Coat	Main Room	NAD
FPB-03B	Plaster-Gray Base Coat	Main Room	NAD
FPB-04A	Plaster-White Skim Coat	Entrance to Children's Section	NAD
FPB-04B	Plaster-Gray Base Coat	Entrance to Children's Section	NAD
FPB-05A	Joint Compound	Entrance to Children's Section	NAD
FPB-05B	Drywall	Entrance to Children's Section	NAD
FPB-06A	Plaster-White Skim Coat	At Adult Section	NAD
FPB-06B	Plaster-Gray Base Coat	At Adult Section	NAD
FPB-07A	White Textured Coat	Server Room	NAD
FPB-07B	Joint Compound	Server Room	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-07C	Drywall	Server Room	NAD
FPB-08	Acoustical Wall Tile 1'x1'	Children's Section	NAD
FPB-09	Acoustical Wall Tile 1'x1'	Children's Section	NAD
FPB-10A	White Acoustical Tile	Children's Section	NAD
FPB-10B	Brown Mastic Patty	Children's Section	NAD
FPB-11A	Yellow Mastic	Entrance to Children's Section	NAD
FPB-11B	Leveling Compound	Entrance to Children's Section	NAD
FPB-11C	12"x12" Orange Floor Tile	Entrance to Children's Section	NAD
FPB-11D	Black Mastic	Entrance to Children's Section	NAD
FPB-12A	Yellow Mastic	Entrance to Children's Section	NAD
FPB-12B	12"x12" Orange Floor Tile	Entrance to Children's Section	NAD
FPB-12C	Black Mastic	Entrance to Children's Section	NAD
FPB-13	Brown Mastic Patty	Server Room	NAD
FPB-14A	Gray Leveling compound	Entrance to Adult Section	NAD
FPB-14B	Yellow Mastic	Entrance to Adult Section	NAD
FPB-15A	Yellow Mastic	Entrance to Adult Section	NAD
FPB-15B	12"x12" Orange Floor Tile	Entrance to Adult Section	NAD
FPB-15C	Black Mastic	Entrance to Adult Section	NAD
FPB-16A	Yellow Mastic	Adult Section	NAD
FPB-16B	12"x12" Orange Floor Tile	Adult Section	NAD
FPB-16C	Black Mastic	Adult Section	NAD
FPB-17A	Plaster-White Skim Coat	Employee Rest Room	NAD
FPB-17B	Plaster-Tan Base Coat	Employee Rest Room	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch
3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-18A	Plaster-White Textured Coat	Stairwell	NAD
FPB-18B	Plaster-White Skim Coat	Stairwell	NAD
FPB-18C	Plaster-Brown Base Coat	Stairwell	NAD
FPB-19	Grout with 12"x12" Ceramic Tile	Employee Rest Room	NAD
FPB-20A	12"x12" White Floor Tile	Public Rest Room	NAD
FPB-20B	Yellow mastic	Public Rest Room	NAD
FPB-21A	12"x12" White Floor Tile	Public Rest Room	NAD
FPB-21B	Yellow mastic	Public Rest Room	NAD
FPB-22A	12"x12" Brown Floor Tile	Side Entry Vestibule	NAD
FPB-22B	Yellow mastic	Side Entry Vestibule	NAD
FPB-22C	Gray Leveling Compound	Side Entry Vestibule	NAD
FPB-22D	Off-White Mastic	Side Entry Vestibule	NAD
FPB-23A	12"x12" Brown Floor Tile	Side Entry Vestibule	NAD
FPB-23B	Yellow mastic	Side Entry Vestibule	NAD
FPB-23C	Gray Leveling Compound	Side Entry Vestibule	NAD
FPB-23D	Off-White Mastic	Side Entry Vestibule	NAD
FPB-24	Grout with 4"x4" Terra Cotta Tile	Main Entry Vestibule	NAD
FPB-25	Toilet Caulk	Public Rest Room	NAD
FPB-26	Toilet Caulk	Employee Rest Room	NAD
FPB-27A	Drywall Joint Compound	Public Rest Room	NAD
FPB-27B	Drywall	Public Rest Room	NAD
FPB-28A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-28B	Brown Brick	Hall/Stairs Lower Level	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-29A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-29B	Brown Brick	Hall/Stairs Lower Level	NAD
FPB-30A	Plaster-White Textured Coat	Staff Work Area	NAD
FPB-30B	Plaster-White Skim Coat	Staff Work Area	NAD
FPB-30C	Plaster-Tan Base Coat	Staff Work Area	NAD
FPB-31	Flange Sealant	Boiler Room	NAD
FPB-32	Flange Sealant	Boiler Room	NAD
FPB-33	Yellow Tape	Boiler Room	NAD
FPB-34A	Yellow Tape	Boiler Room	NAD
FPB-34B	White Mastic on Duct	Boiler Room	NAD
FPB-35A	Black Mastic	Staff Room	NAD
FPB-35B	**Black Floor Tile**	**Staff Room**	**4% Chrysotile**
FPB-35C	Yellow Mastic	Staff Room	NAD
FPB-36A	Black Mastic	Staff Room	NAD
FPB-36B	**Black Floor Tile**	**Staff Room**	**4% Chrysotile**
FPB-36C	Yellow Mastic	Staff Room	NAD
FPB-37A	**9"x9" Black Floor Tile with White Streaks**	**Staff Closet**	**3% Chrysotile**
FPB-37B	Black Mastic	Staff Closet	NAD
FPB-38A	**9"x9" Black Floor Tile with White Streaks**	**Staff Closet**	**3% Chrysotile**
FPB-38B	Black Mastic	Staff Closet	NAD
FPB-39A	Joint Compound	Kitchen	NAD
FPB-39B	Drywall	Kitchen	NAD
FPB-40A	12"x12" Tan Floor Tile	Kitchen	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-40B	Yellow Mastic	Kitchen	NAD
FPB-40C	Gray Leveling Compound	Kitchen	NAD
FPB-40D	Black Mastic	Kitchen	NAD
FPB-41A	12"x12" Tan Floor Tile	Kitchen	NAD
FPB-41B	Yellow Mastic	Kitchen	NAD
FPB-41C	Gray Leveling Compound	Kitchen	NAD
FPB-41D	Black Mastic	Kitchen	NAD
FPB-42	Brown Cove Base Mastic	Kitchen	NAD
FPB-43	Brown Cove Base Mastic	Hall	NAD
FPB-44	**Black Sink Insulation**	**Kitchen**	**3% Chrysotile**
FPB-45	2'x4' Divot and Dot Ceiling Tile	Staff Room	NAD
FPB-46A	Plaster-White Skim Coat	Staff Room	NAD
FPB-46B	Plaster-Tan Base Coat	Staff Room	NAD
FPB-47	2'x4' Divot and Dot Ceiling Tile	Hall Lower Level	NAD
FPB-48A	**9"x9" Brown Floor Tile**	**Storage Lower Lever**	**3% Chrysotile**
FPB-48B	**Black Mastic**	**Storage Lower Lever**	**2% Chrysotile**
FPB-48C	Tan Cementitious Material	Storage Lower Lever	NAD
FPB-49A	**9"x9" Brown Floor Tile**	**Storage Lower Lever**	**3% Chrysotile**
FPB-49B	**Black Mastic**	**Storage Lower Lever**	**2% Chrysotile**
FPB-50A	12"x12" Orange Floor Tile	Storage Lower Lever	NAD
FPB-50B	**Black Mastic**	**Storage Lower Lever**	**3% Chrysotile**
FPB-51A	12"x12" Orange Floor Tile	Storage Lower Lever	NAD
FPB-51B	**Black Mastic**	**Storage Lower Lever**	**3% Chrysotile**

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-52A	12"x12" Green Floor Tile	Multi-Purpose Room Lower Level	NAD
FPB-52B	Tan Mastic	Multi-Purpose Room Lower Level	NAD
FPB-52C	**Black Mastic**	**Multi-Purpose Room Lower Level**	**4% Chrysotile**
FPB-53A	12"x12" Green Floor Tile	Multi-Purpose Room Lower Level	NAD
FPB-53B	Tan Mastic	Multi-Purpose Room Lower Level	NAD
FPB-53C	White Leveling Compound	Multi-Purpose Room Lower Level	NAD
FPB-54	Grout with 4"x4" Terra Cotta Tile	Multi-Purpose Room Lower Level	NAD
FPB-55A	Joint Compound	Multi-Purpose Room Lower Level	NAD
FPB-55B	Drywall	Multi-Purpose Room Lower Level	NAD
FPB-56A	12"x12" Pink Floor Tile	Lower Lever Staff Rest Room	NAD
FPB-56B	Tan Mastic	Lower Lever Staff Rest Room	NAD
FPB-56C	**Black Mastic**	**Lower Lever Staff Rest Room**	**3% Chrysotile**
FPB-57A	12"x12" Pink Floor Tile	Lower Lever Staff Rest Room	NAD
FPB-57B	Tan Mastic	Lower Lever Staff Rest Room	NAD
FPB-57C	**Black Mastic**	**Lower Lever Staff Rest Room**	**3% Chrysotile**
FPB-58A	Tan Decorative Wall	Lower Lever Staff Rest Room	NAD
FPB-58B	Plaster-White Skim Coat	Lower Lever Staff Rest Room	NAD
FPB-59	Tan Decorative Plaster Wall	Lower Lever Staff Rest Room	NAD
FPB-60	Tan Decorative Plaster Wall	Lower Lever Staff Rest Room	NAD
FPB-61A	Black Waterproofing on Brick	Hall/Stairs Lower Level	NAD
FPB-61B	Tan Brick	Hall/Stairs Lower Level	NAD
FPB-62A	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-62B	Drywall	Multi-Purpose Room Storage	NAD

Table 1: Asbestos Bulk Samples for Enoch Pratt Free Library Forest Park Branch 3023 Garrison Boulevard, Baltimore, Maryland, May 30, 2024

Sample Number	Material	Functional Area	NOTES
FPB-63	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-64	Decorative Wall Coating	Multi-Purpose Room Storage	NAD
FPB-65	Exterior Window Glazing Compound	Exterior	NAD
FPB-66	Exterior Window Glazing Compound	Exterior	NAD
FPB-67	**Exterior Window Caulk**	**Exterior**	**3% Chrysotile**
FPB-68	Black Door Caulk	Exterior	NAD
FPB-69	**Exterior Window Caulk**	**Exterior**	**3% Chrysotile**
FPB-70	Exterior Window Glazing Compound	Exterior	NAD
FPB-71	**White Caulk on Vent**	**Exterior**	**3% Chrysotile**
FPB-72A	Gray Expansion Joint Mastic	Exterior	NAD
FPB-72B	**Tan Expansion Joint Mastic**	**Exterior**	**2% Chrysotile**
FPB-73	**White Façade Mastic**	**Exterior**	**3% Chrysotile**
FPB-74	**Exterior Window Caulk**	**Exterior/Boiler Room**	**3% Chrysotile**
FPB-75	**White Façade Mastic**	**Exterior**	**3% Chrysotile**
FPB-76	Gray Expansion Joint Mastic	Exterior	NAD

* NAD – No Asbestos Detected. Bold type indicates an asbestos-containing material.

Testing for asbestos confirmed the presence of asbestos-containing materials including:

- 9"x9" floor tile of various colors located throughout the lower level,
- Floor tile mastic associated with 12"x12" Floor Tile throughout the lower level,
- Black sink insulation,
- Exterior window caulk,
- Exterior vent caulk,
- Exterior expansion joint mastic, and
- Exterior façade mastic.

Assumed materials included:

- Fire doors,

- Mirror mastic in restrooms,
- Roofing materials.

Limitations: Suspect asbestos-containing materials were not sampled if they were located behind solid walls and ceilings, or in enclosed pipe chases that would have to be damaged to access the suspect building materials. Asbestos-containing pipe insulation, duct insulation, mudded elbows, fittings, and valves may be present on concealed plumbing and mechanical systems, including those in chases and behind solid ceilings and walls or located underground. The roof was not sampled to accessibility issues. All roofing materials will be assumed positive until sampled and proven otherwise.

B. Lead

A lead-based paint survey was not performed, however, based upon the age of the structure and the presence of interior and exterior painted wood, plaster and drywall surfaces, lead-paint is likely present. Furthermore, the building is considered a child occupied facility and will require compliance with the OSHA Lead in Construction Standard, Maryland Reduction of Lead Risk in Housing, and Lead Renovation Repair and Painting Rules.

C. Polychlorinated Biphenyls

Fluorescent lamp ballasts were identified to be present in the building. A representative number of fluorescent light ballasts should be inspected for the presence or absence of the "No PCBs" label. If the "No PCBs" label is absent, then the ballast is considered to contain PCBs. The number of ballasts was estimated based upon the type of light fixture observed in the building.

D. Mercury

Two-foot and 4-foot fluorescent lamps were identified in the building. Further investigation to obtain accurate counts will be required because disposal of fluorescent light tubes is regulated under the EPA Universal Waste rule.

E. Refrigerants

No equipment containing refrigerants were identified at the library.

F. Other Universal and Regulated Waste

The survey for hazardous materials indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to demolition activities on the building. Those materials could include:

- Emergency lights which contain a battery
- Exit signs which contain a battery, and
- Automatic door closers which contain oil,

V. CONCLUSIONS

The survey for hazardous materials at the Forest Park Branch Library, located in Baltimore, Maryland indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to proposed demolition. The survey for hazardous materials included all accessible spaces of the interior and exterior of the library.

Asbestos: Asbestos-containing materials identified through sampling and analysis, and those materials that are presumed without testing to contain asbestos are:

- 9"x9" floor title of various colors throughout the lower level
- Mastic associated with 12"x12" throughout the lower level
- Black sink insulation
- Exterior window caulk
- Exterior vent caulk
- Exterior expansion joint mastic
- Exterior façade mastic
- Wood Doors (Assumed)
- Mirror Masic (Assumed)
- Roofing Materials (Assumed)

According to the USEPA National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations, all friable asbestos-containing materials and those materials likely to become friable during renovation must be removed by a licensed asbestos abatement contractor.

Lead: Lead paint is likely present due to the age of the building. A lead-based paint survey was not conducted, but it is recommended to be performed prior to any demolition or renovations intended for this building.

The information contained within this report is intended to address the presence of lead-based paint to ensure worker protection requirements are met under the Occupational Safety and Health Administration's (OSHA) "Lead in Construction Rule (29 CFR 1926.62)." The presence of lead-containing substances is presumed in any residential building construction before 1978 and in all commercial, industrial, and public structures unless it is determined that all painted surfaces are lead-free. According to the OSHA Lead in Construction regulation, lead may still be present and hazardous lead exposures might result from the disturbance of painted surfaces that have below the definition of lead-based paint (i.e. <0.7 mg/cm^2 or 0.5% lead by weight) for lead-based paint. Furthermore, lead may be present in waste materials at concentrations that would cause the waste to be considered hazardous per the Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA).

Recommendations: The survey for hazardous materials at 610 Ruthsburg Road indicated the presence of hazardous or regulated materials that will require proper packaging and disposal prior to renovation or demolition. Our recommendations are summarized below:

1. Remove and dispose of all asbestos-containing 9"x9" floor tiles identified at various locations throughout the lower level (staff area) of the library.
2. Remove and dispose of asbestos-containing black sink insulation identified in the kitchen/break room of the library.
3. Remove and dispose of all asbestos-containing black mastic identified in association of 12"x12" floor tile located throughout the lower level of the library.
4. Remove and dispose of asbestos-containing exterior window caulk from all windows.
5. Remove and dispose of asbestos-containing exterior vent caulk.
6. Remove and dispose of asbestos-containing exterior expansion joint mastic.
7. Remove and dispose of asbestos-containing exterior façade mastic.
8. Sample and analyze or remove mirror mastic as assumed asbestos containing materials.
9. Sample and analyze or remove roofing as assumed asbestos containing materials.
10. Sample and analyze or remove fire doors as assumed asbestos containing materials.

11. Remove and dispose of battery-containing lighted exit signs and emergency lights as universal waste.
12. Remove and dispose of oil-containing automatic door closers.
13. Inspect fluorescent lamp ballasts for a "no PCBs" label. Dispose of any that DO NOT have this label as PCB-containing waste.
14. Remove and dispose of fluorescent lamps, compact fluorescent bulbs and incandescent bulbs as universal waste.
15. Materials may be concealed behind solid walls, ceilings or in pipe chases. Demolition activities have the potential to expose additional asbestos-containing materials. Caution should be taken while demolishing solid ceilings and walls.
16. Lead-based paint was not surveyed but is expected to be present, due to the age of the facility. It is highly recommended that a full lead-based paint survey is performed. Any disturbance to painted surfaces that contain any detectable levels of lead should be performed in accordance with OSHA "Lead in Construction Rule (29 CFR 1926.62)" and the Lead Renovation, Repair and Painting Rule. Waste should be analyzed by toxicity characteristic leaching procedure (TCLP).

VI. Limitations

This report has been prepared for the exclusive use of the Maryland Department of Transportation, State Highway Administration and/or their agents. This service has been performed in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made. Our conclusions and recommendations are based, in part, upon information provided to us by others and our site observations. We have not verified the completeness or accuracy of the information provided to us by others, unless otherwise noted. Our observations and recommendations are based upon conditions readily visible at the site at the time of our site visit, and upon current industry standards. No observations were made behind solid walls, ceilings or in pipe chases. The report presents assumptions for the existence of hazardous materials in these locations.

By virtue of providing the services described in this report, the preparer does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential danger to public health, safety, or the environment. It is the Client's responsibility to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety, or the environment. Under this scope of services, the preparer assumes no responsibility regarding response actions (e.g. O&M plan, encapsulation, abatement, removal, etc.) initiated as a result of these findings. Response actions are the sole responsibility of the Client and should be conducted in accordance with local, sate, and/or federal requirements, and should be performed by appropriately licensed personnel as warranted.

Attachment A

Inspector's Credentials

Asbestos Accreditation



Julia Fafard
Name

Signature

IMP Review
Course Title

230004825

Exam Date: 10/24/2023
Course Date: 10/10/2023
Exp Date: 10/10/2024

STATE OF MARYLAND

Attachment B

Asbestos Certificates of Analysis and Chain-of-Custody Forms

SEEML Reference Number:
G-240531105
Date Issued: 05/31/2024

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
Fax: (864) 233-6589

Asbestos Analytical Report By: Polarized Light Microscopy

This report has been prepared for **ARIA Environmental** the information and data has been checked for thoroughness and accuracy. The results reported apply only to the materials as received. The documents(s) contained herein are confidential and privileged information intended for the exclusive use of the individual or entity named above. This report shall not be reproduced except in full without SEEML's approval.

Client Project Name: Forest Park Branch Library
The Following report was prepared using this test method(s) contained within this document.

- [x] PLM Bulk Asbestos Fiber Analysis:EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples
- [ ] PLM 400 Point Count (<0.25%) EPA 600/R-93/116
- [ ] PLM 1000 Point Count (<0.1%) EPA 600/R-93/116
- [ ] PLM Carb 435 Level A Reporting Limit (<0.25%)
- [ ] PLM Carb 435 Level B (Reporting limit <0.1%)
- [ ] PLM by EPA/600/R-93/116 with Milling Prep 400 Point Count
- [ ] PLM Vermiculite Initial Screening EPA 600R-93/116
- [ ] PLM Cincinnati Method 600/R-04/004 (Amphibole Only)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 1 Chrysotile & Prep)
- [ ] PLM Vermiculite Method SOF-V 198.8 (Step 2 (Amphibole)

Approved By : *Andrea Berrios*

Thank you for choosing SEEML Labs. We strive to provide superior quality testing, analytical data and customer service. SEEML is accredited through the National Institute of Standards and Technology (NIST) National Voluntary Accreditation Program (NVLAP) for bulk asbestos analysis NVLAP # 201031-0 and licensed by the Texas Department of State Health Services (License Number: 300474). This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US government.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
392A / FPB-01	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Main Room- Yellow Glue
393A / FPB-02	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Main Room- Yellow Glue
394A / FPB-03	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Main Room- Plaster
394B / FPB-03	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/Main Room- Plaster
395A / FPB-04	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Entrance to Children's Section- Plaster
395B / FPB-04	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/Entrance to Children's Section- Plaster
396A / FPB-05	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Entrance to Children's Section- DW/ JC
396B / FPB-05	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Entrance to Children's Section- DW/ JC
397A / FPB-06	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/At Adult Section- Plaster

Approved By: Andrea Berrios

Disclaimer:
The results in this report only apply to the samples as received.
NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

Guidelines for Interpretation:
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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
397B / FPB-06	**None Detected**	2% Cellulose	5% Mica,93% Gypsum	(Gray) Plaster/At Adult Section- Plaster
398A / FPB-07	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Server Room- DW/ JC
398B / FPB-07	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Server Room- DW/ JC
398C / FPB-07	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Server Room- DW/ JC
399A / FPB-08	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Acoustical Wall Tile 1'x1'
400A / FPB-09	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Acoustical Wall Tile 1'x1'
401A / FPB-10	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Children's Section- Brown Mastic Patty
401B / FPB-10	**None Detected**	3% Talc	97% Organic Matrix	(Brown) Mastic/Children's Section- Brown Mastic Patty
402A / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound

Approved By: Andrea Berrios

Disclaimer:
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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
402B / FPB-11	**None Detected**	2% Cellulose	98% Gypsum	(Gray) Plaster/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
402C / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Orange) Flooor Tile/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
402D / FPB-11	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Leveling Compound
403A / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
403B / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
403C / FPB-12	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Children's Section- 12'x12" Orange FT/ Mastic Carpet Mastic
404A / FPB-13	**None Detected**	30% Fiberglass,60% Min Wool	10% Binder/Filler	(White) Ceiling Tile/Server Room- Brown Mastic Patty
404B / FPB-13	**None Detected**	2% Talc	98% Organic Matrix	(Brown) Mastic/Server Room- Brown Mastic Patty
405A / FPB-14	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Entrance to Adult Section- Leveling Compound

Approved By: Andrea Berrios

Disclaimer:
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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
405B / FPB-14	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Adult Section- Leveling Compound
406A / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
406B / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
406C / FPB-15	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Entrance to Adult Section- 12"x12" Orange FT/ Mastic/ Carpet Mastic
407A / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
407B / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
407C / FPB-16	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Adult Section- 12"x12" Orange FT/Mastic/ Carpet Mastic
408A / FPB-17	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Employee RR-Plaster
408B / FPB-17	**None Detected**	2% Cellulose	98% Gypsum	(Tan) Granular Plaster/Employee RR-Plaster

Approved By: Andrea Berrios

Disclaimer:
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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
409A / FPB-18	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Stairwell- Plaster
409B / FPB-18	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Stairwell- Plaster
409C / FPB-18	**None Detected**	2% Cellulose	98% Gypsum	(Brown) Granular Plaster/Stairwell-Plaster
410A / FPB-19	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Grout/Employee RR- Plaster
411A / FPB-20	**None Detected**	None Detected	100% Organic Matrix	(White) Floor Tile/Public RR- 12"x12" White FT/ Mastic
411B / FPB-20	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Public RR- 12"x12" White FT/ Mastic
412A / FPB-21	**None Detected**	None Detected	100% Organic Matrix	(White) Floor Tile/Public RR- 12"x12" White FT/ Mastic
412B / FPB-21	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Public RR- 12"x12" White FT/ Mastic
413A / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Brown) Floor Tile/Side Entry Vestibule-12"x12" FT/Mastic

Approved By: Andrea Berrios

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
413B / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
413C / FPB-22	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Side Entry Vestibule- 12"x12" FT/Mastic
413D / FPB-22	**None Detected**	None Detected	100% Organic Matrix	(Off-White) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
414A / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Brown) Floor Tile/Side Entry Vestibule-12"x12" FT/Mastic
414B / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
414C / FPB-23	**None Detected**	None Detected	100% Binder/Filler	(Gray) Leveling Compound/Side Entry Vestibule- 12"x12" FT/Mastic
414D / FPB-23	**None Detected**	None Detected	100% Organic Matrix	(Off-White) Mastic/Side Entry Vestibule-12"x12" FT/Mastic
415A / FPB-24	**None Detected**	None Detected	100% Carbon/Quartz	(Black) Grout/Main Entry Vestibule-Grout with 4'x4' Terra Cotta Tile
416A / FPB-25	**None Detected**	None Detected	100% Organic Matrix	(White) Caulk/Public RR- Toilet Caulk

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
417A / FPB-26	**None Detected**	None Detected	100% Organic Matrix	(White) Caulk/Employee RR- Toilet Caulk
418A / FPB-27	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Public RR- DW/JC
418B / FPB-27	**None Detected**	20% Cellulose	80% Gypsum	(Off-White) Drywall/Public RR- DW/JC
419A / FPB-28	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Hall/ Stairs LL- Black Waterproofing on Brick
419B / FPB-28	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Brick/Hall/ Stairs LL- Black Waterproofing on Brick
420A / FPB-29	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Hall/ Stairs LL- Black Waterproofing on Brick
420B / FPB-29	**None Detected**	None Detected	100% Carbon/Quartz	(Brown) Brick/Hall/ Stairs LL- Black Waterproofing on Brick
421A / FPB-30	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Work Area- Plaster
421B / FPB-30	**None Detected**	None Detected	100% Gypsum	(White) Skim Coat/Work Area- Plaster

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
421C / FPB-30	**None Detected**	2% Cellulose	98% Gypsum	(Tan) Granular Plaster/Work Area-Plaster
422A / FPB-31	**None Detected**	None Detected	100% Organic Matrix	(Tan) Sealant/Boiler Room- Flange Sealant
423A / FPB-32	**None Detected**	None Detected	100% Organic Matrix	(Tan) Sealant/Boiler Room- Flange Sealant
424A / FPB-33	**None Detected**	70% Cellulose	30% Organic Matrix	(Yellow) Tape/Boiler Room- Tape/ Mastic on Duct
425A / FPB-34	**None Detected**	70% Cellulose	30% Organic Matrix	(Yellow) Tape/Boiler Room- Tape/ Mastic on Duct
425B / FPB-34	**None Detected**	None Detected	100% Organic Matrix	(White) Mastic/Boiler Room- Tape/ Mastic on Duct
426A / FPB-35	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
426B / FPB-35	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Floor Tile/Staff- Black FT/ Mastic/ Carpet Mastic
426C / FPB-35	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
427A FPB-36	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
427B FPB-36	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Floor Tile/Staff- Black FT/ Mastic/ Carpet Mastic
427C FPB-36	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Staff- Black FT/ Mastic/ Carpet Mastic
428A FPB-37	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Floor Tile/Closet- 9'x9' Black FT w White Streaks/ Mastic
428B FPB-37	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Closet- 9'x9' Black FT w White Streaks/ Mastic
429A FPB-38	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Floor Tile/Closet- 9'x9' Black FT w White Streaks/ Mastic
429B FPB-38	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Closet- 9'x9' Black FT w White Streaks/ Mastic
430A FPB-39	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Kitchen- DW/ JC
430B FPB-39	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Kitchen- DW/ JC

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
431A / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Tan) Floor Tile/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431B / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431C / FPB-40	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Leveling Compound/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
431D / FPB-40	**None Detected**	None Detected	100% Organic Matrix	(Black) Matic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432A / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Tan) Floor Tile/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432B / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Yellow) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432C / FPB-41	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Leveling Compound/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
432D / FPB-41	**None Detected**	None Detected	100% Organic Matrix	(Black) Mastic/Kitchen- 12"x12" White FT/ Mastic/ Leveling Compound
433A / FPB-42	**None Detected**	3% Wollastonite	97% Organic Matrix	(Brown) Mastic/Kitchen- Brown Covebase Mastic

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
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		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
434A / FPB-43	**None Detected**	3% Wollastonite	97% Organic Matrix	(Brown) Mastic/Kitchen- Brown Covebase Mastic
435A / FPB-44	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Sink Undercoat/Kitchen- Black Sink Insulation
436A / FPB-45	**None Detected**	5% Fiberglass,85% Cellulose	5% Binder/Filler,5% Perlite	(Tan) Ceiling Tile/Staff- 2'x4' Divot and Dot Ceiling Tile
437A / FPB-46	**None Detected**	None Detected	100% Gypsum	(White) Skimcoat/Staff- Plaster Ceiling
437B / FPB-46	**None Detected**	2% Animal Hair	98% Gypsum	(Tan) Granular Plaster/Staff- Plaster Ceiling
438A / FPB-47	**None Detected**	20% Fiberglass,65% Cellulose	10% Perlite,5% Binder/Filler	(White) Ceiling Tile/Hall- 2x4' Divot and Dot Ceiling Tile
439A / FPB-48	**3% Chrysotile**	None Detected	97% Organic Matrix	(Brown) Floor Tile/Storage- 9"x9" Brown FT/ Mastic
439B / FPB-48	**2% Chrysotile**	None Detected	98% Organic Matrix	(Black) Mastic/Storage- 9"x9" Brown FT/ Mastic
439C / FPB-48	**None Detected**	None Detected	100% Gypsum	(Tan) Cementitious Material/Storage- 9"x9" Brown FT/ Mastic

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PLM Asbestos Bulk Sample Summary

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		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
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		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
440A / FPB-49	**3% Chrysotile**	None Detected	97% Organic Matrix	(Brown) Floor Tile/Storage- 9"x9" Brown FT/ Mastic
440B / FPB-49	**2% Chrysotile**	None Detected	98% Organic Matrix	(Black) Mastic/Storage- 9"x9" Brown FT/ Mastic
441A / FPB-50	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Storage- 12"x12" Orange FT/ Mastic
441B / FPB-50	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/Storage- 12"x12" Orange FT/ Mastic
442A / FPB-51	**None Detected**	None Detected	100% Organic Matrix	(Orange) Floor Tile/Storage- 12"x12" Orange FT/ Mastic
442B / FPB-51	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/Storage- 12"x12" Orange FT/ Mastic
443A / FPB-52	**None Detected**	None Detected	100% Organic Matrix	(Green) Floor Tile/Multi- Purpose Room- 12"x12" Green FT/ Mastic
443B / FPB-52	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic
443C / FPB-52	**4% Chrysotile**	None Detected	96% Organic Matrix	(Black) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic

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PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
444A / FPB-53	**None Detected**	None Detected	100% Organic Matrix	(Green) Floor Tile/Multi- Purpose Room- 12"x12" Green FT/ Mastic
444B / FPB-53	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/Multi- Purpose Room- 12"x12" Green FT/ Mastic
444C / FPB-53	**None Detected**	None Detected	100% Binder/Filler	(White) Leveling Compound/Multi- Purpose Room- 12"x12" Green FT/ Mastic
445A / FPB-54	**None Detected**	None Detected	100% Carbon/Quartz	(Gray) Grout/Multi- Purpose Room- Grout 4"x4" Terra Cotta Tile
446A / FPB-55	**None Detected**	None Detected	100% Binder/Filler	(White) Joint Compound/Multi- Purpose Room- DW/ JC
446B / FPB-55	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Multi- Purpose Room- DW/ JC
447A / FPB-56	**None Detected**	None Detected	100% Organic Matrix	(Pink) Floor Tile/LL Staff RR- 12"x12" Pink FT/ Mastic
447B / FPB-56	**None Detected**	None Detected	100% Organic Matrix	(Tan) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
447C / FPB-56	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic

Approved By: Andrea Berrios

Disclaimer:
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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. NAD means no asbestos fibers were detected. When detected the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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Southeast Environmental Microbiology Laboratories - Asbestos Division
102 Edinburgh Court Greenville, SC 29607
Phone: 864-233-3770, Fax: 864-233-6589 , www.seeml.com
NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
448A / FPB-57	**None Detected**	None Detected	100% Organic Matrix	(Pink) Floor Tile/LL Staff RR- 12"x12" Pink FT/ Mastic
448B / FPB-57	**None Detected**	3% Cellulose	97% Organic Matrix	(Tan) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
448C / FPB-57	**3% Chrysotile**	None Detected	97% Organic Matrix	(Black) Mastic/LL Staff RR- 12"x12" Pink FT/ Mastic
449A / FPB-58	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
449B / FPB-58	**None Detected**	None Detected	100% Gypsum	(White) Plaster/LL Staff RR- Decorative Plaster Wall
450A / FPB-59	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
451A / FPB-60	**None Detected**	None Detected	100% Binder/Filler	(Tan) Texture/LL Staff RR- Decorative Plaster Wall
452A / FPB-61	**None Detected**	None Detected	100% Organic Matrix	(Black) Water Proofing/Hall Stairs- Black Waterproofing on Brick
452B / FPB-61	**None Detected**	None Detected	100% Carbon/Quartz	(Tan) Brick/Hall Stairs- Black Waterproofing on Brick

Approved By: Andrea Berrios

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NOB samples are tested as a preliminary analysis. We highly recommend for Negative NOB samples resulting in less than 1% Asbestos to be verified by TEM or Point Analysis.

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: / Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
453A / FPB-62	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
453B / FPB-62	**None Detected**	10% Cellulose	90% Gypsum	(White) Drywall/Multi- Purpose Storage-Decorative Coating on DW
454A / FPB-63	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
455A / FPB-64	**None Detected**	None Detected	100% Binder/Filler	(White) Texture/Multi- Purpose Storage-Decorative Coating on DW
456A / FPB-65	**None Detected**	None Detected	100% Organic Matrix	(White) Glazing/Exterior- Exterior Window Glazing Compound
457A / FPB-66	**None Detected**	None Detected	100% Binder/Filler	(White) Glazing/Exterior- Exterior Window Caulk
458A / FPB-67	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- Exterior Window Caulk
459A / FPB-68	**None Detected**	None Detected	100% Organic Matrix	(Black) Caulk/Exterior- Back Door Caulk
460A / FPB-69	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- Exterior Window Caulk

Approved By: Andrea Berrios

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NVLAP Lab ID:201031-0 Texas Lic: 300474

PLM Asbestos Bulk Sample Summary

Client:	ARIA Environmental ,, /bsciorilli@ariaenviro.com	Date Sampled:	05/31/2024
		Date Received:	05/31/2024
		Date Analyzed:	05/31/2024
		Date Reported:	05/31/2024
		Date Revised:	
		Project Name:	Forest Park Branch Library
		Project No:	
Analyzed by:	Jessica Orchet	Project Address:	3023 Garrison Boulevard
		City, State. ZIP:	Baltimore, MD
Methodology:	EPA – Appendix E to Subpart E of 40 CFR Part 763; Interim Method for the Determination of Asbestos in Bulk Insulation Samples.	SEEML Ref#:	G-240531105

Lab No.: Client No.:	% Asbestos Type	% Fibrous Non-Asbestos Material Type	% Non-Fibrous Material	Description/Location
461A FPB-70	**None Detected**	None Detected	100% Binder/Filler	(White) Glazing/Exterior- Exterior Window Glazing Compound
462A FPB-71	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Caulk on Vent
463A FPB-72	**None Detected**	None Detected	100% Organic Matrix	(Gray) Mastic/Exterior- Gray Expansion Joint
463B FPB-72	**2% Chrysotile**	None Detected	98% Binder/Filler	(Tan) Compound/Exterior- Gray Expansion Joint
464A FPB-73	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Facade Mastic
465A FPB-74	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior/ Boiler Room-Exterior Window Caulk
466A FPB-75	**3% Chrysotile**	None Detected	97% Binder/Filler	(White) Caulk/Exterior- White Facade Mastic
467A FPB-76	**None Detected**	None Detected	100% Organic Matrix	(Gray) Mastic/Exterior- Gray Expansion Joint Mastic

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SEEML Labs
Analytical Solutions For a Healthy Indoor Environment

Southeast Environmental Microbiology Laboratories AKA- SEEML Labs

Chain of Custody- 102 Edinburgh Ct., Greenville, SC 29607; Phone: 864-233-3770; www.seeml.com

Company:	ARIA Environmental	**Contact Person:**	**Brian Sciorilli**
Email:	bsciorilli@ariaenviro.com	**Phone:**	**443-864-2813**
Project Name/ Number:	**Forest Park Branch Library**	**Date Sampled:**	5/30/24
Project Address, City, State, Zip:	3023 Garrison Boulevard Baltimore, MD		

Requested Services

Mold/Bacteria Analysis

*Mold Air - Spore Trap	*Non-Fungal Particulate Air - Spore Trap	Mold Direct t- Swab, Tape, Bulk	**Culturable Mold – Swab, Bulk, *Air	***Total Coliform, *E. coli* (Presence /Absence)

Asbestos Analysis

***Sewage Assessment (Presence/ Absence)	PLM 600-R-93-116 (<1%)	PLM 600-R-93-116 (<1%) With Gravimetric	PLM Point Count 400 (<0.25%)	PLM Point Count 1000 (0.1%)	PLM CARB 435	Cincinnati Method EPA 600/R-04/004 by PLM	*PCM	Positive Stop	Hard Stop

Other

TEM	Lead (Pb), *Lead Air	Other: Specify:

Required Turnaround Time:

- ☐ Rush
- ☒ Same Business Day
- ☐ Next Business Day
- ☐ Two Business Days
- ☐ Three Business Days
- ☐ Five Business Days
- ☐ Other-Specify in Notes

Check Appropriate Test. Please note asbestos positive stops need to be checked above the notes section of the COC. *Volume is pump setting (L/min.) X minutes ran. ** Area is only required for culturable surface samples. ***Needed for bacterial samples.

Client Sample ID:	Sample Location/Description	*Volume	**Area	***Time Collected	Mold/Bacteria Analysis					Asbestos Analysis									Other		
	Sample Sheet Attached				☐	☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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Inspector Notes/Special Instructions:

All Samples PLM

Relinquished By:	John Rhea	**Received By:**		**Samples Acceptable?** ☐ YES ☐ NO	**SEEML Reference Number:** G-240531105
Date/Time:	5/30/24 / 3:30 pm	**Date/ Time:**			**SEEML Lab ID:** 392-467

G-240531P5
392-467

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-01	Yellow Carpet Glue	Main Room	
FPB-02	Yellow Carpet Glue	Main Room	
FPB-03	Plaster	Main Room	
FPB-04	Plaster	Entrance to Children's Section	
FPB-05	Drywall Joint Compound	Entrance to Children's Section	
FPB-06	Plaster	At Adult Section	
FPB-07	Drywall Joint Compound	Server Room	
FPB-08	Acoustical Wall Tile 1'x1'	Children's Section	
FPB-09	Acoustical Wall Tile 1'x1'	Children's Section	
FPB-10	Brown Mastic Patty	Children's Section	
FPB-11	12"x12" Orange FT/Mastic Leveling Compound	Entrance to Children's Section	
FPB-12	12"x12" Orange FT/Mastic/ Carpet Mastic	Entrance to Children's Section	
FPB-13	Brown Mastic Patty	Server Room	
FPB-14	Leveling compound	Entrance to Adult Section	
FPB-15	12"x12" Orange FT/Mastic/ Carpet Mastic	Entrance to Adult Section	
FPB-16	12"x12" Orange FT/Mastic/ Carpet Mastic	Adult Section	
FPB-17	Plaster	Employee RR	
FPB-18	Plaster	Stairwell	
FPB-19	Grout with 12"x12" Ceramic Tile	Employee RR	
FPB-20	12"x12" White FT/Mastic	Public RR	
FPB-21	12"x12" White FT/Mastic	Public RR	
FPB-22	12"x12" FT/Mastic	Side Entry Vestibule	Color unknown
FPB-23	12"x12" FT/Mastic	Side Entry Vestibule	Color unknown

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-24	Grout with 4"x4" Terra Cotta Tile	Main Entry Vestibule	
FPB-25	Toilet Caulk	Public RR	
FPB-26	Toilet Caulk	Employee RR	
FPB-27	Drywall Joint Compound	Public RR	
FPB-28	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-29	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-30	Plaster	Work Area	
FPB-31	Flange Sealant	Boiler Room	
FPB-32	Flange Sealant	Boiler Room	
FPB-33	Tape/Mastic on Duct	Boiler Room	
FPB-34	Tape/Mastic on Duct	Boiler Room	
FPB-35	Black FT/Mastic/Carpet Mastic	Staff	
FPB-36	Black FT/Mastic/Carpet Mastic	Staff	
FPB-37	9"x9" Black FT with White Streaks/Mastic	Closet	
FPB-38	9"x9" Black FT with White Streaks/Mastic	Closet	
FPB-39	Drywall Joint Compound	Kitchen	
FPB-40	12"x12" White FT/Mastic/Leveling Compound	Kitchen	
FPB-41	12"x12" White FT/Mastic/Leveling Compound	Kitchen	
FPB-42	Brown Cove Base Mastic	Kitchen	
FPB-43	Brown Cove Base Mastic	Hall	
FPB-44	Black Sink Insulation	Kitchen	
FPB-45	2'x4' Divot and Dot Ceiling Tile	Staff	

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

Sample Number	Material	Functional Area	NOTES
FPB-46	Plaster ceiling	Staff	
FPB-47	2'x4' Divot and Dot Ceiling Tile	Hall	
FPB-48	9"x9" Brown FT/Mastic	Storage	
FPB-49	9"x9" Brown FT/Mastic	Storage	
FPB-50	12"x12" Orange FT/Mastic	Storage	
FPB-51	12"x12" Orange FT/Mastic	Storage	
FPB-52	12"x12" Green FT/Mastic	Multi-Purpose Room	
FPB-53	12"x12" Green FT/Mastic	Multi-Purpose Room	
FPB-54	Grout with 4"x4" Terra Cotta Tile	Multi-Purpose Room	
FPB-55	Drywall Joint Compound	Multi-Purpose Room	
FPB-56	12"x12" Pink FT/Mastic	LL Staff RR	
FPB-57	12"x12" Pink FT/Mastic	LL Staff RR	
FPB-58	Decorative Plaster Wall	LL Staff RR	
FPB-59	Decorative Plaster Wall	LL Staff RR	
FPB-60	Decorative Plaster Wall	LL Staff RR	
FPB-61	Black Waterproofing on Brick	Hall/Stairs LL	
FPB-62	Decorative coating on DW	Multi-purpose Storage	
FPB-63	Decorative coating on DW	Multi-purpose Storage	
FPB-64	Decorative coating on DW	Multi-purpose Storage	
FPB-65	Exterior Window Glazing Compound	Exterior	
FPB-66	Exterior Window Glazing Compound	Exterior	
FPB-67	Exterior Window Caulk	Exterior	
FPB-68	Black Door Caulk	Exterior	

Asbestos Bulk Samples for Forest Park Branch Library
24-1467

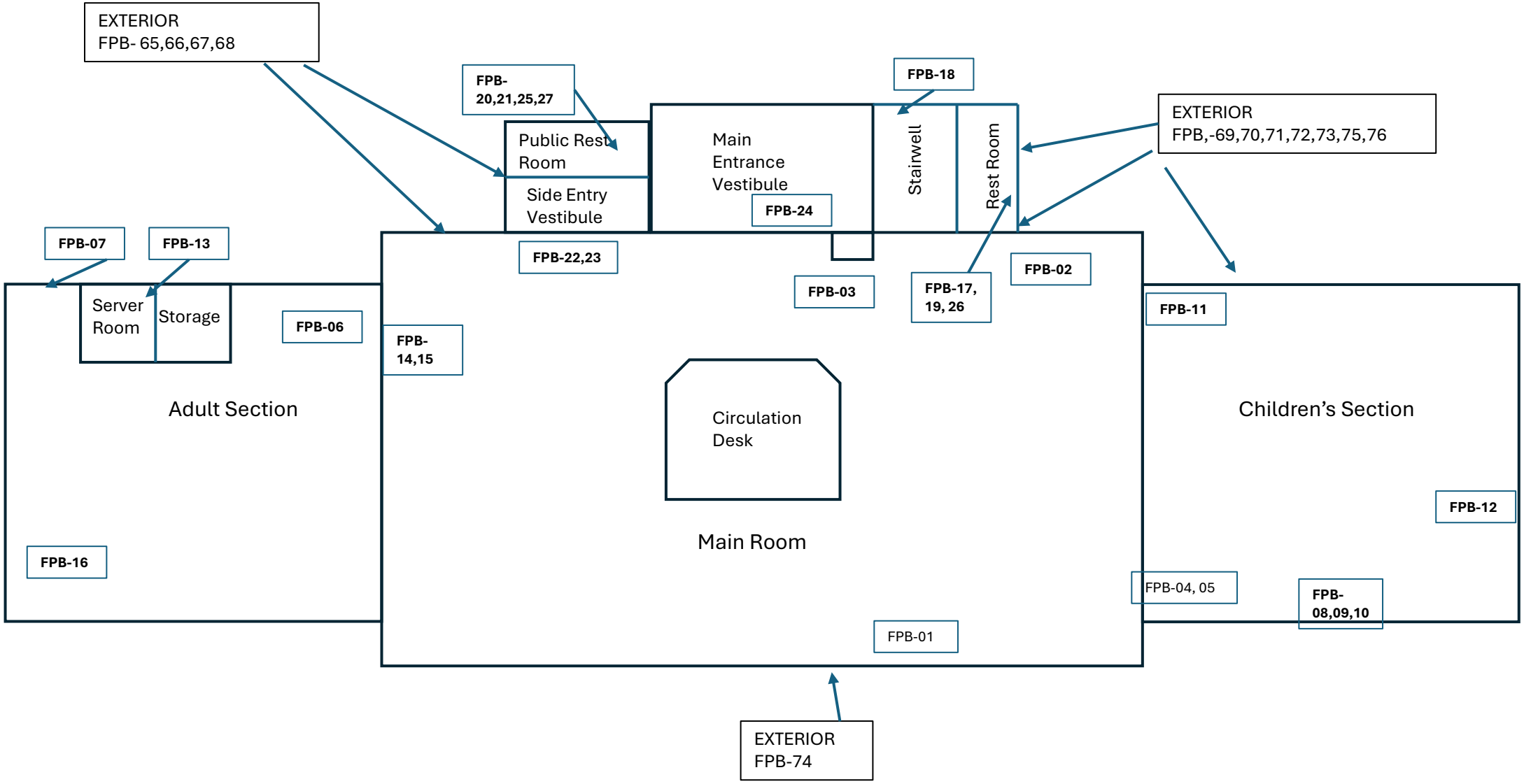
Sample Number	Material	Functional Area	NOTES
FPB-69	Exterior Window Caulk	Exterior	
FPB-70	Exterior Window Glazing Compound	Exterior	
FPB-71	White Caulk on Vent	Exterior	
FPB-72	Gray Expansion Joint Mastic	Exterior	
FPB-73	White Façade Mastic	Exterior	
FPB-74	Exterior Window Caulk	Exterior/Boiler Room	
FPB-75	White Façade Mastic	Exterior	
FPB-76	Gray Expansion Joint Mastic	Exterior	

Attachment C:

Sample Location Plan

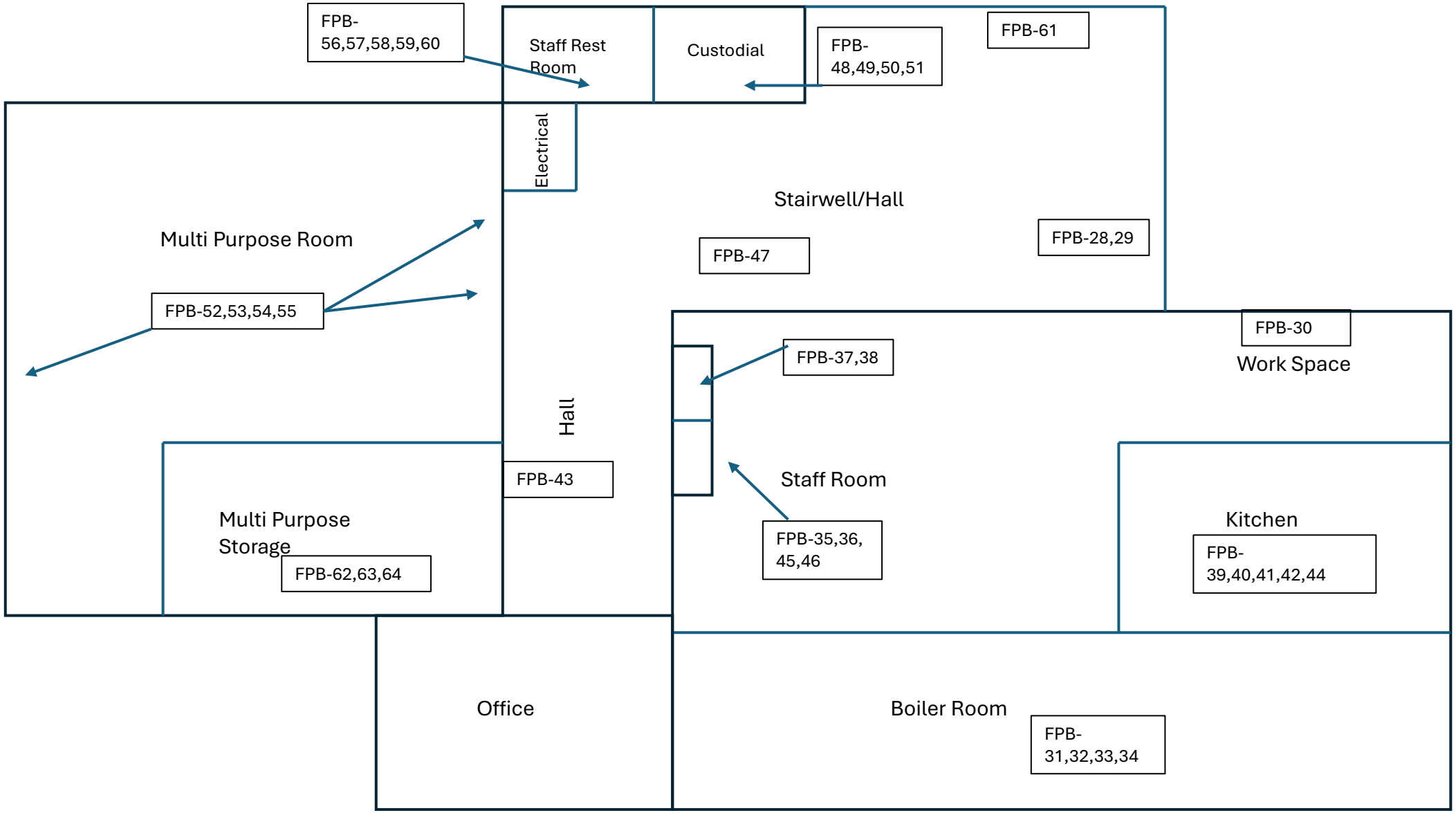
Enoch Pratt Free Library Forest Park Branch

Sample Location Drawing – Main Level



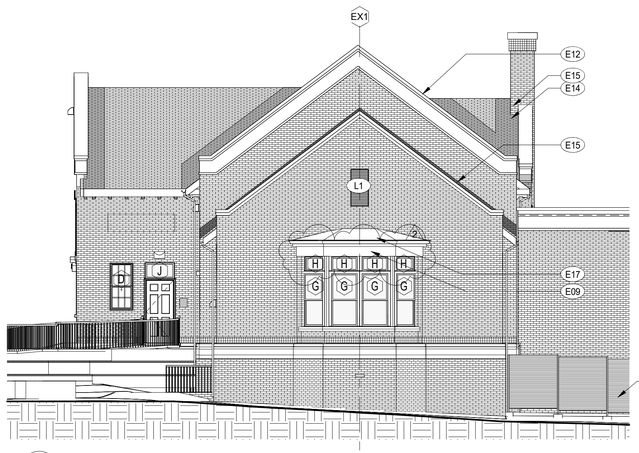
Enoch Pratt Free Library Forest Park Branch

Sample Location Drawing – Lower Level

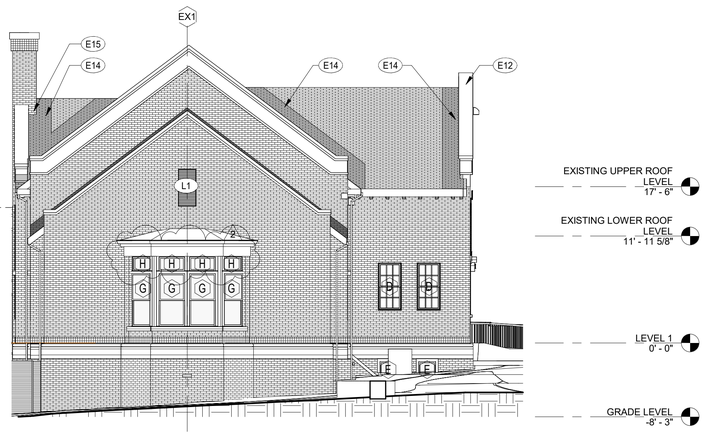




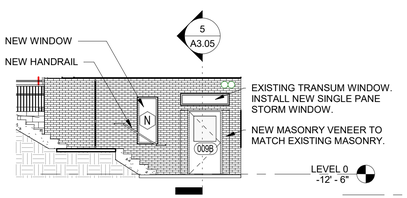
4 A3.00 ELEVATION - WEST
1/8" = 1'-0"



3 A3.00 ELEVATION - SOUTH
1/8" = 1'-0"



2 A3.00 ELEVATION - NORTH
1/8" = 1'-0"



5 A3.00 EXTERIOR EXIT CORRIDOR ELEVATION
1/8" = 1'-0"



1 A3.00 ELEVATION - EAST
1/8" = 1'-0"

SYMBOL LEGEND

EXISTING CONSTRUCTION

NEW CONSTRUCTION

ELEVATION NOTES

22	NEW FIRE DEPARTMENT CONNECTION.
24	SIGNAGE "NO SMOKING PERMITTED WITHIN 25' OF ENTRANCE" SIGN @ 48" AFF. SIGN PROVIDED BY OWNER.
E01	BRICK VENEER; MATCH EXISTING, MORTAR; MATCH EXISTING.
E06	WOOD TRIM; BROWN, TO MATCH EXISTING TRIM.
E09	BAY WINDOW TRIM AND GUTTER BOARD; WHITE, TO MATCH NEW WINDOWS.
E10	NEW DOWNSPOUT, BRACKETS, PIPE CONNECTIONS ETC.
E12	REINSTALL ALL LOOSE COPING STONES, MORTOR, SEALANT, ETC.
E13	NEW SLATE SHINGLES, UNDERLAYMENT, AND FLASHINGS ON ENTIRE WING.
E14	REINSTALL EXISTING SLATE SHINGLES AND AUGMENT WITH NEW SLATE SHINGLES AS REQUIRED FOR INSTALLATION OF NEW FLASHINGS.
E15	NEW COPPER FLASHING.
E17	NEW BAY COPPER ROOFING, FLASHING, UNDERLAYMENT, GUTTER AND DOWNSPOUT.
L1	L1 LOUVER
L2	L2 LOUVER
L3	L3 LOUVER

ADD ALTERNATE #1
REPOINT ALL EXISTING BRICK NOT SHOWN TO BE REPOINTED ON SHEETS AD1.10 AND AD1.11.

PRIME AE
5521 Research Park Drive, Suite 300, Baltimore, MD 21228 | 410-654-3790

Professional Certification: I certify that these documents were preparted or approved by me, ant that I am a duly licensed Architect under the laws of the State of Maryland. License number 15225, Expiration Date: 11/30/2025

ADDITION & RENOVATION FOR ENOCH PRATT FREE LIBRARY FOREST PARK BRANCH

3023 Garrison Blvd., Baltimore, MD 21216

AUGUST 29, 2025

100% CD

Revisions:

No.	Date	Description
2	10/8/2025	Addendum #2

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PRIME AE Group, Inc.

EXTERIOR ELEVATION - EXISTING BUILDING

A3.00

SHEET 56 OF 179

22057

10/8/2025 5:21:05 PM

WINDOW SCHEDULE

Type Mark	Height	Width	Type Comments	Comments
A	5' - 11 1/2"	3' - 3 1/2"	ALUM CLAD WOOD DH	EXTERIOR BRICK MOLD TO MATCH EXISTING PROFILE
B	1' - 11 1/2"	8' - 11 1/2"	ALUM CLAD WOOD AWNING	TRIPLE GANGED WINDOW
C	5' - 10"	2' - 2 1/2"	ALUM CLAD WOOD FIXED	
D	5' - 3 1/2"	2' - 7 1/2"	ALUM CLAD WOOD DH	EXTERIOR BRICK MOLD TO MATCH EXISTING PROFILE
E	2' - 0"	2' - 0"	ALUM CLAD FIXED	
F	5' - 3 1/2"	3' - 7 1/2"	ALUM CLAD WOOD DH	EXTERIOR BRICK MOLD TO MATCH EXISTING PROFILE
G	6' - 0"	3' - 0"	ALUM CLAD WOOD DH	EXISTING TRANSUM ABOVE DOOR X105
H	1' - 8"	3' - 0"	ALUM CLAD FIXED	GANGED WITH TYPE G WINDOW
J	1' - 10"	3' - 4"	ALUM CLAD WOOD FIXED TRANSUM	
K	6' - 3 1/2"	3' - 7 1/2"	ALUM CLAD WOOD DH	EXTERIOR BRICK MOLD TO MATCH EXISTING PROFILE
Z	2' - 4"	2' - 6"		EXISTING TRANSUM ABOVE DOOR X105

ALUMINUM CLAD WOOD WINDOW GENERAL NOTES:

REFER TO THE PROJECT MANUAL FOR COMPLETE SPECIFICATIONS.

A. WINDOW SIZES INDICATED ARE APPROXIMATIONS. ALL MASONRY OPENINGS AND ROUGH OPENINGS ARE TO BE FIELD VERIFIED.
B. DESIGN INTENT IS TO MATCH EXISTING WINDOW CONFIGURATION. EXTERIOR TRIM, INTERIOR TRIM, BRICK MOLD, ETC. TO MATCH EXISTING UNLESS NOTED OTHERWISE.
C. INSTALL WOOD BLOCKING AS REQUIRED TO REPLACE EXISTING UNSUTABLE MATERIALS WITH FRT/MOISTURE TREATED WOOD BLOCKING.

GLAZING SCHEDULE

TYPE	DESCRIPTION
GL-1	3/8" LAMNATED GLAZING
GL-2	1" IG 1/4"-1/2"-1/4" GLAZING, HEAT STRENGTHENED, LOW E
GL-3	3/8" LAMNATED GLAZING W/ CERAMIC FRIT

LOUVER SCHEDULE

Type Mark	Width	Height	Comments
	<varies>	<varies>	
L1	2' - 0"	4' - 2"	2" BLADE SPACING
L2	1' - 4"	1' - 4"	2" BLADE SPACING
L3	3' - 0"	5' - 4"	2" BLADE SPACING

LOUVER GENERAL NOTES:

REFER TO THE PROJECT MANUAL FOR COMPLETE SPECIFICATIONS.

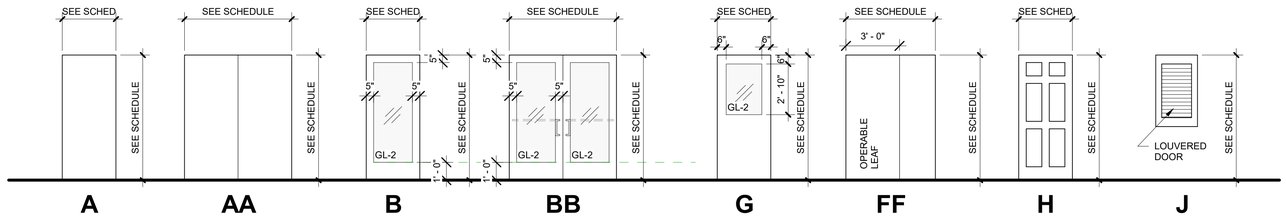
A. LOUVER SIZES INDICATED ARE APPROXIMATIONS. ALL MASONRY OPENINGS AND ROUGH OPENINGS ARE TO BE FIELD VERIFIED.
B. DESIGN INTENT IS TO MATCH EXISTING LOUVER CONFIGURATIONS. EXTERIOR TRIM, BRICK MOLD, ETC. TO MATCH EXISTING UNLESS NOTED OTHERWISE.
C. INSTALL WOOD BLOCKING AS REQUIRED TO REPLACE EXISTING UNSUTABLE MATERIALS WITH FRT/MOISTURE TREATED WOOD BLOCKING.

DOOR AND FRAME SCHEDULE

DOOR #	DOOR TYPE	DOOR FIRE RATING	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR SIZE THK	DOOR PANEL MATERIAL	FRAME MATERIAL	DETAIL HEAD	DETAIL JAMB	DETAIL SILL	HARDWARE SET	REMARKS
002	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	5/A5.06	11.0	
003	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	9/A5.06	9.0	J
005	FF		5' - 0"	7' - 0"	0' - 1 3/4"	WOOD	HM	3/A5.06	2/A5.06	1/A5.06	7.0	B, K
006	G		3' - 0"	7' - 0"	0' - 1 3/4"	WOOD/SG	HM	3/A5.06	2/A5.06	1/A5.06	10.0	
007A	G		3' - 0"	7' - 0"	0' - 1 3/4"	WOOD/SG	HM	3/A5.06	2/A5.06	13/A5.06	12.0	
007B	A		3' - 0"	7' - 0"	0' - 1 3/4"	WOOD	HM	3/A5.06	2/A5.06	9/A5.06	17.0	P
008	FF		5' - 0"	7' - 0"	0' - 1 3/4"	WOOD	HM	19/A5.06	18/A5.06	9/A5.06	8.0	K
009A	AA		6' - 0"	7' - 10"	0' - 1 3/4"	WOOD	AL	11/A5.06	14/A5.06	9/A5.06	3.0	C
009B	G		3' - 6"	7' - 0"	0' - 1 3/4"	HM/SG	HM	19/A5.06	18/A5.06	17	2.0	D, E, F, H
010	AA		6' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	1/A5.06	8.0	
011	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	19/A5.06	18/A5.06	9/A5.06	6.0	
016	J		2' - 4"	4' - 0"	0' - 1 3/4"	HM/SG	HM	19/A5.06*	18/A5.06*	18/A5.06*	011	M
101			3' - 0"	7' - 0"	0' - 1 3/4"			MATCH EXT	MATCH EXT	MATCH EXT	16.0	H
106	B		3' - 0"	7' - 0"	0' - 1 3/4"	AL/SG	AL				4.0	
107	B		3' - 0"	7' - 0"	0' - 1 3/4"	AL/SG	AL				4.0	
108	B		3' - 0"	7' - 0"	0' - 1 3/4"	AL/SG	AL				4.0	
110	BB		6' - 0"	7' - 0"	0' - 1 3/4"	AL/SG	AL	16/A5.06	12/A5.06	17/A5.06	1.0	A,E
111	BB		6' - 0"	7' - 0 1/8"	0' - 1 3/4"	AL/SG	AL				5.0	A,E
112A	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	1/A5.06	11.0	N
112B	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	1/A5.06	11.0	N
112C	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06	1/A5.06	11.0	N
113	A		3' - 0"	7' - 0"	0' - 1 3/4"	SC WOOD	HM	3/A5.06	2/A5.06		17.0	N

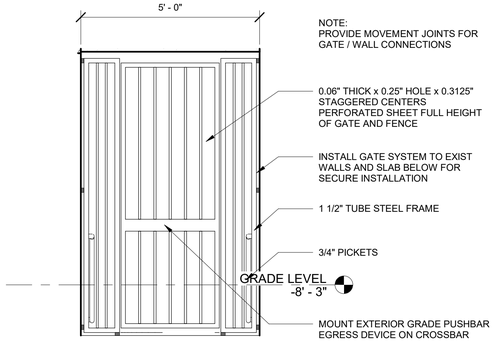
DOOR AND FRAME SCHEDULE - EXISTING DOORS

DOOR #	DOOR TYPE	DOOR FIRE RATING	DOOR PANEL MATERIAL	FRAME MATERIAL	DETAIL HEAD	DETAIL JAMB	DETAIL SILL	HARDWARE SET	REMARKS
X001	ETR		ETR	ETR	ETR	ETR	ETR	14.0	J, L
X100					ETR	ETR	ETR	15.0	J, L
X101B					ETR	ETR	ETR	15.0	J L
X102					ETR	ETR	ETR	15.0	J, L
X103					ETR	ETR	ETR	15.0	J, L
X105					ETR	ETR	ETR	15.0	J, L
XST01					ETR	ETR	ETR	15.0	J, L
XST03					ETR	ETR	ETR	15.0	ALL EXTERIOR DOORS SHALL HAVE LOW PROFILE ALUMINUM THRESHOLDS MEETING THE REQUIREMENTS OF ADA.



NOTE: ALL GLAZING TO BE SAFETY GLASS UNLESS OTHERWISE NOTED OR SCHEDULED

2 / A5.00 DOOR TYPES
1/4" = 1'-0"



1 / A5.00 METAL EGRESS GATE
1/2" = 1'-0"

DOOR AND DOOR FRAME GENERAL NOTES

1 ALL EXTERIOR DOORS SHALL HAVE LOW PROFILE ALUMINUM THRESHOLDS MEETING THE REQUIREMENTS OF ADA.
2 ALL EXTERIOR STEEL DOORS SHALL BE GALVANIZED.
3 ALL EXTERIOR STEEL DOOR FRAMES SHALL BE GALVANIZED.
4 ALL EXTERIOR DOORS SHALL HAVE A DRIP CAP AND TOP CAP AT HEAD OF DOOR.
5 ALL EXTERIOR DOORS SHALL BE WEATHERSTRIPED WITH BOTTOM SWEEPS.
6 ALL EXTERIOR STEEL DOORS SHALL BE INSULATED GLASS.
7 VERIFY ACTUAL THROAT DEPTH OF ALL DOOR FRAMES WITH WALL/PARTITION.
8 ALL GLASS IN DOORS AND SIDE LITES SHALL BE SAFETY GLASS. PROVIDE FIRE RATED GLASS WHERE INDICATED ON DOOR AND FRAME SCHEDULE OR AS NOTED ON DRAWINGS.
9 ALL EXTERIOR DOOR FRAMES SHALL BE SEALED & CAULKED AROUND PERIMETER, HEAD, SILL AND JAMBS.
10 PROVIDE PAD LOCKS KEYED INTO MASTER KEY SYSTEM AT ROOF HATCHES.

DOOR HARDWARE GENERAL NOTES

1 CONTRACTOR SHALL REVIEW KEYING OF ALL DOORS WITH OWNER PRIOR TO FABRICATION OF CORES. KEY INTO OWNERS EXISTING MASTER KEY SYSTEM.
2 ALL DOOR SHALL MEET ALL ADA GUIDELINES
3 ALL DOORS EQUIPPED WITH LOCKS SHALL ALLOW EGRESS FROM WITHIN THE ROOM WITHOUT THE USE OF KEYS, SPECIAL TOOLS OR KNOWLEDGE.

DOOR FRAME AND HARDWARE ABBREVIATIONS

AL	ALUMINUM
HM	HOLLOW METAL
INSUL	INSULATED
LAM	LAMINATED
MIN	MINUTE
MTL	METAL
SG	SAFETY GLASS
WD	WOOD
ETR	EXISTING TO REMAIN

REMARKS

A. AUTOMATIC DOOR OPENER
B. ACCESS CONTROL
C. NOT USED
D. ALARMED EXIT DEVICE
E. INSULATED GLASS
F. SURFACE MOUNTED WINDOW SHADE IN DOOR LITE
G. SEE MANUFACTURER SPECS AND SIZES
H. EXTERIOR INSULATED DOOR
J. REFINISH EXISTING DOOR, FRAME, TRANSOM PANEL, ETC. TO MATCH EXISTING. REPLACE WEATHER SEALS ON EXTERIOR DOORS.
K. SEE DETAIL 1/A5.00 FOR EGRESS GATE INFORMATION.
L. REMOVE, CLEAN, AND REINSTALL EXISTING HARDWARE. REPLACE ANY NON-OPERATIONAL, NON MATCHING HARDWARE, OR AS SPECIFIED TO BE NEW.
M. MASONRY WALL. NO INTERIOR FRAMING AND GWB
N. UNDERCUT DOOR 1"
P. DOOR TO HAVE ACOUSTIC DOOR SEAL AND AUTOMATIC DOOR BOTTOM.

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Revisions:

No.	Date	Description
1	2/7/2025	PERMIT REVISIONS
2	10/8/2025	Addendum #2

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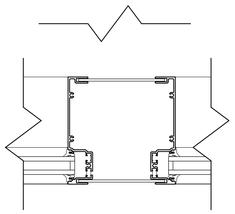
DOOR & WINDOW SCHEDULE

A5.00

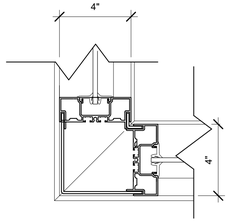
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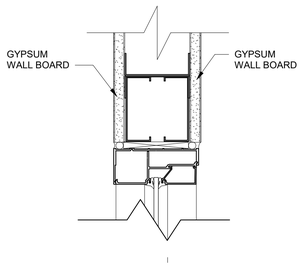
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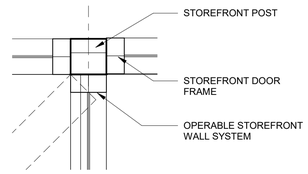
22 A5.05 SF JAMB DETAIL
3" = 1'-0"



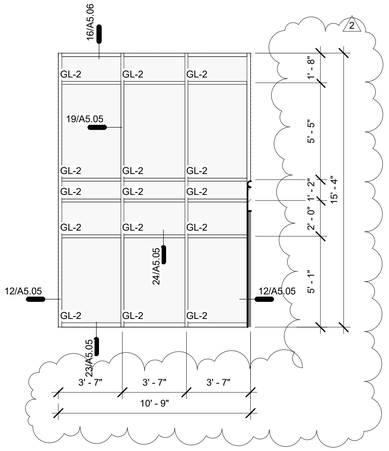
17 A5.05 INTERIOR SF CORNER DETAIL
3" = 1'-0"



12 A5.05 INTERIOR SF HEAD & JAMB DETAIL
3" = 1'-0"

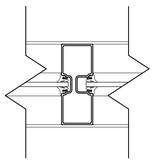


7 A5.05 POST DETAIL
1 1/2" = 1'-0"

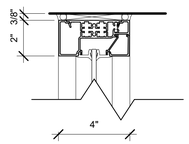


ALUMINUM FRAMED STOREFRONT : ES-1B

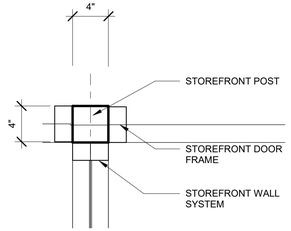
3 A5.05 ES02 ELEVATION
1/4" = 1'-0"



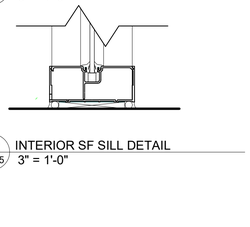
11 A5.05 INTERIOR SF VERT MULLION DETAIL
3" = 1'-0"



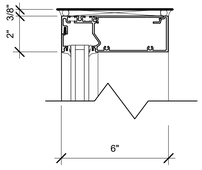
16 A5.05 INTERIOR SF HEAD DETAIL
3" = 1'-0"



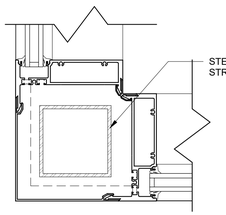
6 A5.05 POST DETAIL
1 1/2" = 1'-0"



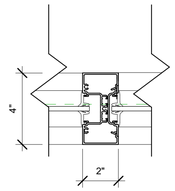
10 A5.05 INTERIOR SF SILL DETAIL
3" = 1'-0"



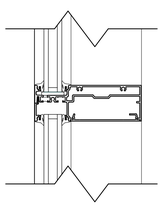
25 A5.05 HEAD / jamb DETAIL
3" = 1'-0"



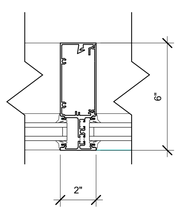
20 A5.05 SF OUTSIDE CORNER DETAIL
3" = 1'-0"



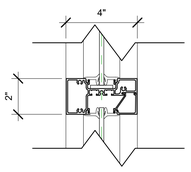
15 A5.05 INTERIOR SF VERT MULLION
3" = 1'-0"



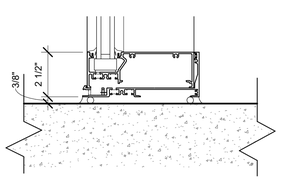
24 A5.05 MULLION DETAIL - HORIZONTAL
3" = 1'-0"



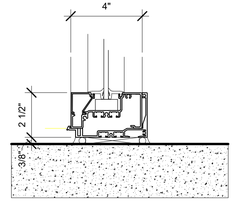
19 A5.05 SF MULLION DETAIL - VERTICAL
3" = 1'-0"



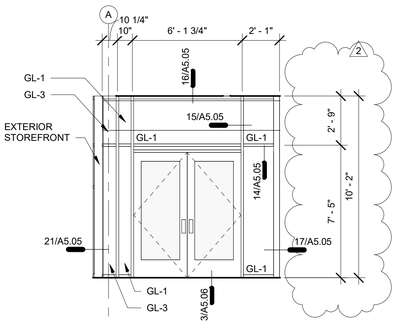
14 A5.05 INTERIOR SF HORIZ MULLION
3" = 1'-0"



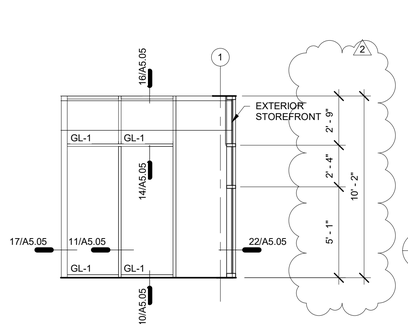
23 A5.05 SF SILL DETAIL
3" = 1'-0"



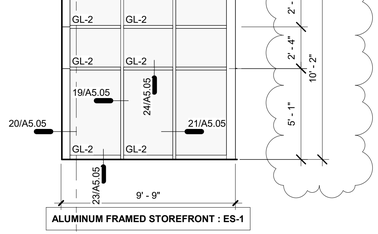
13 A5.05 INTERIOR SF SILL DETAIL
3" = 1'-0"



9 A5.05 SF3 ELEVATION
1/4" = 1'-0"

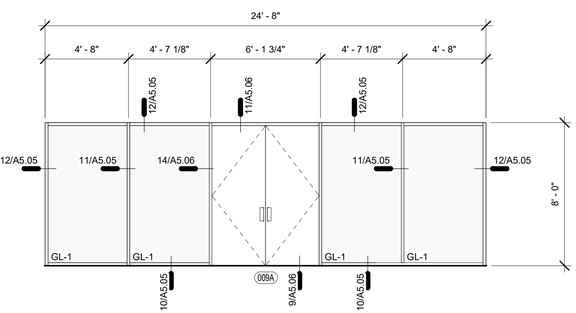


5 A5.05 SF2 ELEVATION
1/4" = 1'-0"

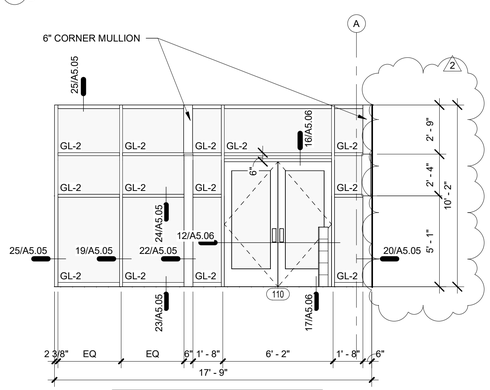


ALUMINUM FRAMED STOREFRONT : ES-1

2 A5.05 ES01B ELEVATION
1/4" = 1'-0"



4 A5.05 SF1 ELEVATION
1/4" = 1'-0"



ALUMINUM FRAMED STOREFRONT : ES-1A

1 A5.05 ES01A ELEVATION
1/4" = 1'-0"

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Revisions:

No.	Date	Description
2	10/8/2025	Addendum #2

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GLAZING ELEVATIONS / DETAILS

A5.05

SHEET 67 OF 179

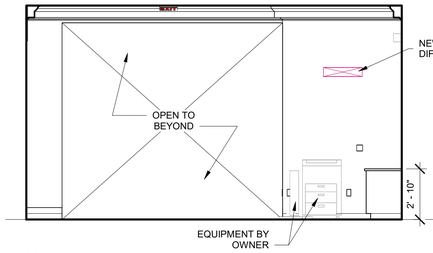
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INTERIOR ELEVATIONS GENERAL NOTES

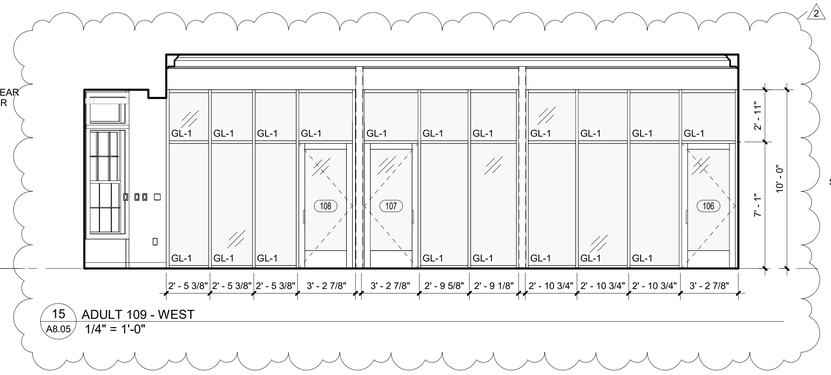
1. SEE ROOM FINISH SCHEDULE AND LEGEND FOR MATERIAL AND FINISH INFORMATION.
2. ALL HOLLOW METAL DOORS AND FRAMES TO BE PAINTED.
3. PAINT ALL EXPOSED DUCTWORK, CONDUIT, PIPING, AND EXPOSED STEEL.
4. ALL TILED FLOORS AND WALLS IN RESTROOMS TO HAVE EPOXY GROUT.

INTERIOR ELEVATIONS LEGEND

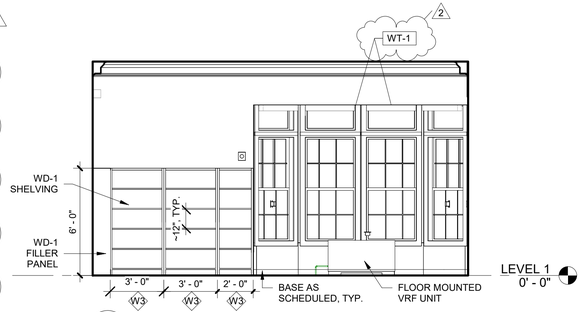
- (T) INDICATES LOCATION OF TEMPERED GLAZING
- (1) INDICATES LOCATION OF CASEWORK. SEE A9 SERIES FOR FURTHER INFORMATION
- MB-XX INDICATES LOCATION OF MARKER BOARD. SEE A8.00 FOR FURTHER INFORMATION
- TB-XX INDICATES LOCATION OF TACK BOARD. SEE A8.00 FOR FURTHER INFORMATION



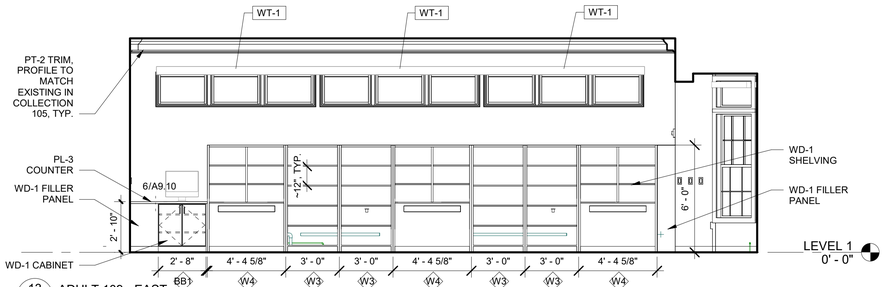
16 A8.05 ADULT 109 - NORTH
1/4" = 1'-0"



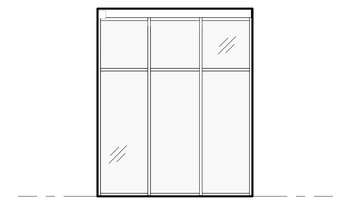
15 A8.05 ADULT 109 - WEST
1/4" = 1'-0"



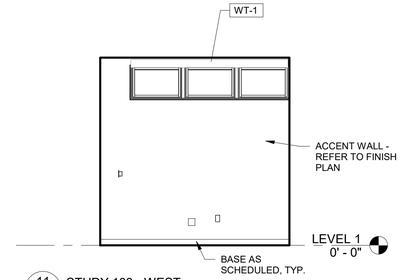
14 A8.05 ADULT 109 - SOUTH
1/4" = 1'-0"



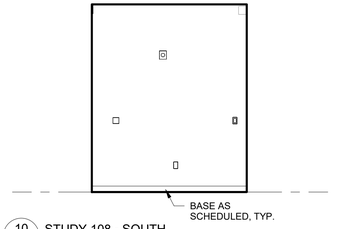
13 A8.05 ADULT 109 - EAST
1/4" = 1'-0"



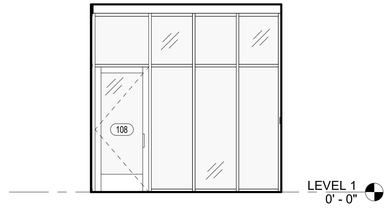
12 A8.05 STUDY 108 - NORTH
1/4" = 1'-0"



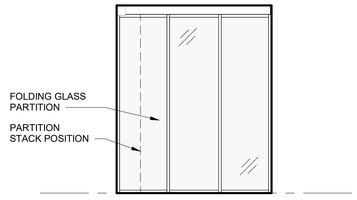
11 A8.05 STUDY 108 - WEST
1/4" = 1'-0"



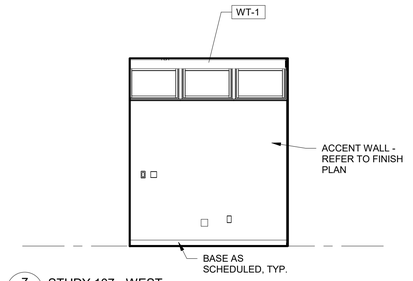
10 A8.05 STUDY 108 - SOUTH
1/4" = 1'-0"



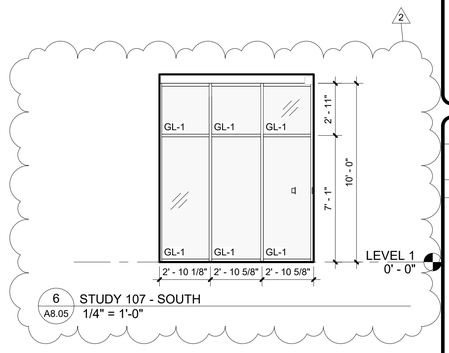
9 A8.05 STUDY 108 - EAST
1/4" = 1'-0"



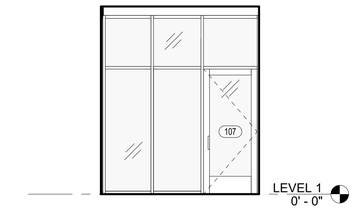
8 A8.05 STUDY 107 - NORTH
1/4" = 1'-0"



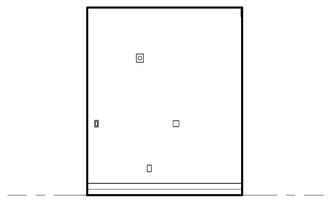
7 A8.05 STUDY 107 - WEST
1/4" = 1'-0"



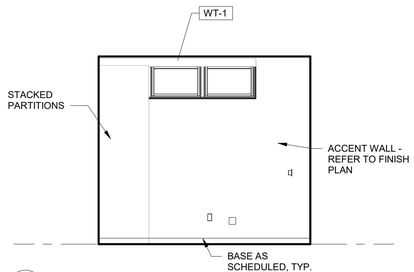
6 A8.05 STUDY 107 - SOUTH
1/4" = 1'-0"



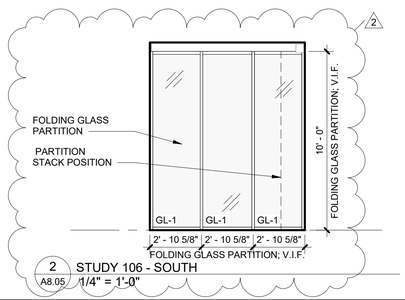
5 A8.05 STUDY 107 - EAST
1/4" = 1'-0"



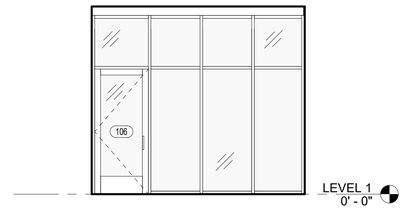
4 A8.05 STUDY 106 - NORTH
1/4" = 1'-0"



3 A8.05 STUDY 106 - WEST
1/4" = 1'-0"



2 A8.05 STUDY 106 - SOUTH
1/4" = 1'-0"



1 A8.05 STUDY 106 - EAST
1/4" = 1'-0"

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Revisions:

No.	Date	Description
2	10/8/2025	Addendum #2

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INTERIOR ELEVATIONS

A8.05
SHEET 82 OF 172
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