PROJECT MANUAL

ST FRANCIS NEIGHBORHOOD CENTER ADDITION AND RENOVATIONS

2405 Linden Ave, Baltimore, MD 21217

Architect's Project No: #21005

Prepared By:
RM SOVICH ARCHITECTURE
DATE: 10 JANUARY 2023

PROJECT MANUAL

ST FRANCIS NEIGHBORHOOD CENTER ADDITION AND RENOVATIONS

2405 Linden Ave, Baltimore, MD 21217

Architect's Project No: #21005

OWNER:

St. Francis Neighborhood Center
2405 Linden Ave,
Baltimore, MD 21217

DEVELOPER:

Episcopal Housing Corporation
3986 Roland Avenue
Baltimore, MD 21211

CIVIL ENGINEER:

Colbert Matz Rosenfelt, Inc.
2835 Smith Avenue, Suite G
Baltimore MD 21209

ARCHITECT:

RM Sovich Architecture
1 Village Square Suite 175
Baltimore, MD 21210

STRUCTURAL ENGINEER:

SKARDA & Associates, Inc.
2439 N Charles St,
Baltimore, MD 21218

MEP ENGINEER:

Henry Adams, LLC
600 Baltimore Ave, Suite 400
Baltimore, MD 21204

INVITATION TO BID

PROJECT:

ST FRANCIS NEIGHBORHOOD CENTER ADDITION | 2405 LINDEN AVENUE | BALTIMORE, MD 21217

OWNER:

ST FRANCIS NEIGHBORHOOD CENTER ADDITION | 2405 LINDEN AVENUE | BALTIMORE, MD 21217

DEVELOPER:

EPISCOPAL HOUSING CORPORATION | 3986 ROLAND AVENUE | BALTIMORE, MD 21211

TYPE OF WORK

Invites sealed Bids for addition and interior renovations.

CONTACT/ARCHITECT:

In accordance with bidding documents prepared by:
RM Sovich Architecture | 1 Village Square Suite 175 | Baltimore, MD 21210

SCOPE:

This project is is located at 2405 LINDEN AVENUE | BALTIMORE, MD 21217
The project scope consists of renovations to an existing historic structure and an addition to a recent addition. The scope is best understood in this way:

RENOVATIONS

- Renovations to the existing 2,906 SF structure (1,453 SF on two floors) includes replacing all windows on all floors (except on on the second floor, rear facing the addition.) with historically appropriate windows. Removal of the existing front porch superstructure, new concrete slab to infill the ramp, and new porch column and roof structure. New ADA ramp access to the front porch. New exterior lighting, entrance door and security system. The existing sprinkler system will need to be modified to relocate a riser to permit the installation of a new HVAC unit and extended into the new addition.
- Interior renovations to the first and second floors of the existing structure as indicated on the drawings including new structure supporting new HVAC unit in the attic, modifications to the layout of the existing interior rooms and new finishes, hardware , HVAC distribution, and lighting.

ADDITION

- The 3,256 SF Addition includes 948 SF of classrooms on the second floor and 2,308 SF on the first floor.
- The Addition includes a new covered entrance, Lobby, Hall, Office, and Multipurpose Room.

- The construction is primarily a wood structure constructed on a slab-on-grade.
- The addition includes, new exterior brick and siding on wood framing, a TPO roof system, new metal roof on the rebuilt porch, new windows and exterior doors, interior finishes, lighting, and HVAC.
- The site Work for the project includes modifications to the existing SWM system, grading, landscape, paving, retaining walls, exterior stairs and hand rails, and relocating an existing water line to make room for the new addition foundation. As indicated on the civil engineering drawings.

PROJECT SCHEDULE:

3 March 2023:	Drawings and specifications e-mailed to Bidders
10 March 2023	Mandatory pre-Bid meeting at the site at 10:00 AM
30 March 2023:	Bids are due to from Contractors
18 April 2023:	Approximate date of Board Meeting to approve GC for construction
15 May 2023:	Construction to begin pending building permit
	It is expected the construction will take eight months from commencement.

AVAILABILITY:

PDF files of Bidding Documents will be provided to two prequalified contractors. Production of copies are contractor's responsibility.

TAX EXEMPT STATUS:

St Francis Neighborhood Center is a Maryland Non profit organization. Prior to purchasing materials, the Contractor will request the school's tax exempt status number. Taxes for materials are not to be included in bids.

FUNDING STIPULATIONS:

The funding sources of the project require the following:
Baltimore City certified MBE participation: 27% WBE participation: 10%
Maryland State certified W/MBE combined 29%
Davis-Bacon Prevailing Wage Rates for Baltimore City [An informational schedule of rates are attached to this document–Wage rates are established at the time of the Work.]

TYPE OF BID:

Bids shall be on a Lump-Sum Basis; with alternates and allowances as specified and without additional allowances, except as requested by the Owner, herein. The Agreement for the Work will be written on

AIA Document A102-2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is the Cost of the Work Plus a Fee.

BID SECURITY:

A Bid Bond in the amount of 5% is required.

BOND REQUIREMENT:

A Payment and Performance Bond for 100 % of contract shall be required from successful bidder.

PARTY RECEIVING:

Bids shall be addressed to:

c/o RM Sovich Architecture | 1 Village Square Suite 175 | Baltimore, Maryland 21210

Attention: Randy M. Sovich, FAIA rmsovich@rmsarchitecture.com

QUESTIONS:

Address all questions in writing via e-mail to the Architect no later than 27 February 2023.

PRE BID MEETING:

Pre bid site meeting will be held on site at date TBD at 10:00 am.

TIME AND DATE:

Bids Shall be received via email, until 4:00 PM local time on 30 March 2023.

Hard Copies including Schedule of Values and Draft Schedule must be received by 12:00 PM (noon) on 31 March 2023

BID OPENING:

Bids will be privately opened and read.

WITHDRAWAL PERIOD:

Bid may not be modified, withdrawn or canceled by Bidder within sixty (60) days from the time and date designated for Receipt of Bids.

INSTRUCTIONS TO BIDDERS

For the following PROJECT:

ST FRANCIS NEIGHBORHOOD CENTER ADDITION | 2405 LINDEN AVENUE | BALTIMORE, MD 21217

THE OWNER:

ST FRANCIS NEIGHBORHOOD CENTER ADDITION | 2405 LINDEN AVENUE | BALTIMORE, MD 21217

DEVELOPER:

EPISCOPAL HOUSING CORPORATION | 3986 ROLAND AVENUE | BALTIMORE, MD 21211

THE ARCHITECT:

RM SOVICH ARCHITECTURE | 1 VILLAGE SQUARE, SUITE 175 | BALTIMORE, MD 21210

SECTIONS

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2 BIDDER'S REPRESENTATIONS

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5 CONSIDERATION OF BIDS

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8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

1 DEFINITIONS

1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

2 BIDDER'S REPRESENTATIONS

2.1 The Bidder by making a Bid represents that:

2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

2.1.2 The Bid is made in compliance with the Bidding Documents.

2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

3 BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Invitation to Bid.

3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least seven days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

3.4 ADDENDA

3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

4.3 SUBMISSION OF BIDS

4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and

date for receipt of Bids will be returned unopened.

4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

4.3.4 Oral, telephonic or telegraphic transmitted bids will not be considered.

4.4 MODIFICATION OR WITHDRAWAL OF BID
4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS
5.1 OPENING OF BIDS
At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

5.2 REJECTION OF BIDS
The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

5.3 ACCEPTANCE OF BID (AWARD)
5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION
6.1 CONTRACTOR'S QUALIFICATION STATEMENT
Bidders to whom award of a Contract is under consideration may be asked to submit to the Owner, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 OWNER'S FINANCIAL CAPABILITY
The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to

the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

6.3 SUBMITTALS

6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

7.2 TIME OF DELIVERY AND FORM OF BONDS

7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

7.2.3 The bonds shall be dated on or after the date of the Contract.

7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on *AIA Document A102-2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is the Cost of the Work Plus a Fee.*

BID FORM

TO:

St. Francis Neighborhood Center
2405 Linden Ave,
Baltimore, MD 21217

c/o RM Sovich Architecture Inc.
1 Village Square, Suite 175
Baltimore, MD 21210
rmsovich@rmsarchitecture.com

1. The undersigned Bidder proposes and agrees, if this bid is accepted, to enter into an agreement with the Owner in the form of an AIA Contract to complete all work as specified or indicated in the Contract Documents for the Contract price and within the Contract Time in this bid and in accordance with the Contract Documents.

2. Bidder accepts all terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid Security. The Bidder agrees to maintain and hold the contract price stated in this proposal for a period of sixty (60) days from the date of this proposal.
Bidder, if selected contractor, will, within ten (10) working days, after Notice of Award thereof by the Owner, execute a contract in accordance with the terms of this general bid and as called for in the Instructions to Bidders.

3. In submitting this Bid, Bidder represents, as more fully set forth in the Bidding Documents that:

   a. Bidder has examined copies of all Contract Documents and of the following addenda:

ADDENDUM Number ___ Date:
ADDENDUM Number ___
ADDENDUM Number ___

   b. Receipt of all of which is hereby acknowledged and also copies of the Bidding Requirements including the Instructions to Bidders;

   Bidder has examined the site and locality where the work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations as Bidder deems necessary;

   This bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with the agreement or rules of any group, association, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or

induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by conclusion to obtain for himself any advantage over any other Bidder or over Owner; AND

4. Bidder will complete the work for the following price(s), which does not include Maryland State Tax on material permanently incorporated in the Work, as indicated in the Conditions of the Contract.

a. LUMP SUM CONTRACT PRICE (Also known as Base Bid, Item a)

_____$_____

(Use words) (Figures)

The following documents are attached to and made a condition of the Bid:

(i) Project Draft Schedule.

(ii) Provide Schedule of Values in the following categories with this Bid:

1. General Conditions _____

2. Site Work _____

3. Concrete _____

4. Masonry _____

5. Metals _____

6. Wood & Plastics _____

7. Thermal & Moisture Protection _____

8. Doors & Windows _____

9. Finishes _____

10. Specialties _____

11. Equipment	_____
12. Furnishings	_____
13. Special Construction	_____
14. Conveying Systems	N/A _____
15. Mechanical	_____
16. Electrical	_____
Contractor's Fee (Overhead and Profit)	_____
Total	_____

Add Alternate #1: Complete installation of a Poured rubber outdoor playground surface in the fenced in court area identified on the architectural site plan, an area approximately, 1,720 SF in area.

_____

Allowance for Landscape: $12,000

The terms used in this Bid are defined in the conditions of the Contract included as part of the Contract Documents.

Communications concerning this Bid shall be addressed to the address of the Bidder indicated below:

Submitted on this _____ day of _____ , 2023

(The Bidder is:)

An individual:

By: _____(Seal)
(Individual's name)

BID FORM

doing business as _____

Business Address _____
_____
_____
_____

Phone Number: _____

A Partnership

By: _____
(Firm name)

_____
(General Partner)

Business Address _____
_____
_____
_____

Phone Number: _____

A Corporation

By: _____
(Corporation name)

_____
(State of Incorporation)

By: _____
(Corporation name)

_____
(Name of Person Authorized to Sign)

_____
(Title)

BID FORM

(Corporate Seal)

Business Address _____

_____

_____

_____

Phone Number: _____

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26 43 13	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
26 51 19	LED INTERIOR LIGHTING
28 31 11	ADDRESSABLE FIRE-ALARM SYSTEM WITH VOICE NOTIFICATION
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List of Drawings

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	CIVIL ENGINEERING DRAWING
-SIT 1	SITE PLAN BUILDING PERMIT PLAN
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SWM-1	STORMWATER MANAGEMENT PLAN REVISED AS-BUILT EXISTING CONDITIONS AND DRAINAGE AREA MAP
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FP001 FIRE PROTECTION COVER SHEET

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FP102 SECOND FLOOR PLAN-FIRE PROTECTION-NEW WORK

FP501 FIRE PROTECTION-DETAILS

DOCUMENT 00 60 00 - PROJECT FORMS

1. FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

1. AIA Document AIA Document A102-2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is the Cost of the Work Plus a Fee.

   a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction.

2. The General Conditions are incorporated by reference.

2. ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements Sections.

B. Copies of AIA standard forms may be obtained from the following:

1. The American Institute of Architects:

   www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

C. Preconstruction Forms:

1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."
2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."

D. Information and Modification Forms:

1. Form for Requests for Information (RFIs): AIA Document G716, "Request for Information (RFI)."
2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."
3. Change Order Form: AIA Document G701, "Change Order."
4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."
5. Form of Change Directive: AIA Document G714, "Construction Change Directive."

E. Payment Forms:

1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."
2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."
3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."
5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF DOCUMENT 00 60 00

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*

Signature: _____
Name and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

INFORMATIONAL WAGE RATES

The wage rates listed below are published by the State of Maryland, Division of Labor and Industry, Prevailing Wage Unit.

The wage rates posted on this site are provided for **informational** purposes ONLY.

The wage and fringe rates may change between the time of issuance of the wage determinations and the award of the public works contract. Therefore, prior to the award of the public works contract, verification must be made with the public body, to insure that the rates contained in this determination are still prevailing.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds $250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

BALTIMORE CITY **BUILDING CONSTRUCTION** **Print Date Feb 01, 2023**

CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT
BALANCING TECHNICIAN	AD	$34.74		$10.81
BRICKLAYER	AD	$35.20		$13.14
CARPENTER	AD	$31.40		$14.02
CARPENTER - SHORING SCAFFOLD BUILDER	AD	$31.40		$14.02
CARPET LAYER	AD	$32.08		$14.39
CEMENT MASON	AD	$25.85	027	$10.95
COMMUNICATION INSTALLER TECHNICIAN	AD	$27.53	005	$16.06
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	$31.40		$14.02
ELECTRICIAN	AD	$43.27		$19.21
ELEVATOR MECHANIC	AD	$51.75		$41.62
FIREPROOFER - SPRAYER	AD	$29.70		$7.48
FIRESTOPPER	AD	$29.41		$9.33
GLAZIER	AD	$34.16	005	$13.50
INSULATION WORKER	AD	$39.27		$19.42
IRONWORKER - FENCE ERECTOR	AD	$28.23		$19.64
IRONWORKER - ORNAMENTAL	AD	$31.17	005	$24.38
IRONWORKER - REINFORCING	AD	$29.20		$21.42
IRONWORKER - STRUCTURAL	AD	$32.12		$25.03
LABORER - AIR TOOL OPERATOR	AD	$24.46		$9.34
LABORER - ASPHALT PAVER	AD	$24.46		$9.34
LABORER - ASPHALT RAKER	AD	$14.00		$4.44
LABORER - BLASTER - DYNAMITE	AD	$24.46		$9.34
LABORER - BURNER	AD	$24.46		$9.34
LABORER - COMMON	AD	$14.00		$4.44
LABORER - CONCRETE PUDDLER	AD	$14.00		$4.44
LABORER - CONCRETE SURFACER	AD	$24.46		$9.34
LABORER - CONCRETE TENDER	AD	$14.00		$4.44
LABORER - CONCRETE VIBRATOR	AD	$14.00		$4.44
LABORER - DENSITY GAUGE	AD	$14.00		$4.44
LABORER - FIREPROOFER - MIXER	AD	$14.00		$4.44
LABORER - FLAGGER	AD	$14.00		$4.44

LABORER - GRADE CHECKER	AD	$14.00		$4.44
LABORER - HAND ROLLER	AD	$14.00		$4.44
LABORER - HAZARDOUS MATERIAL HANDLER	AD	$24.46		$9.34
LABORER - JACKHAMMER	AD	$14.00		$4.44
LABORER - LANDSCAPING	AD	$14.00		$4.44
LABORER - LAYOUT	AD	$14.00		$4.44
LABORER - LUTEMAN	AD	$14.00		$4.44
LABORER - MASON TENDER	AD	$24.46		$9.34
LABORER - MORTAR MIXER	AD	$14.00		$4.44
LABORER - PIPELAYER	AD	$24.46		$9.34
LABORER - PLASTERER - HANDLER	AD	$14.00		$4.44
LABORER - SCAFFOLD BUILDER	AD	$24.46		$9.34
LABORER - TAMPER	AD	$14.00		$4.44
MILLWRIGHT	AD	$34.90		$17.16
PAINTER	AD	$26.61		$11.56
PAINTER-INDUSTRIAL	AD	$33.05	005	$14.28
PILEDRIVER	AD	$34.62		$16.51
PLUMBER	AD	$42.62		$23.19
POWER EQUIPMENT OPERATOR - ASPHALT DISTRIBUTOR	AD	$28.92		$12.10
POWER EQUIPMENT OPERATOR - BACKHOE	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - BOOM TRUCK	AD	$33.00	013	$3.69
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	AD	$30.18		$13.67
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	AD	$41.50	005	$0.25
POWER EQUIPMENT OPERATOR - CRANE	AD	$38.70		$16.40
POWER EQUIPMENT OPERATOR - CRANE - TOWER	AD	$38.70		$16.40
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - GRADALL	AD	$33.00	005	$5.87
POWER EQUIPMENT OPERATOR - GRADER	AD	$38.33	005	$5.87
POWER EQUIPMENT OPERATOR - HOIST	AD	$28.68	027	$10.62
POWER EQUIPMENT OPERATOR - LOADER	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - MECHANIC	AD	$32.13		$13.67
POWER EQUIPMENT OPERATOR - MILLING MACHINE	AD	$37.11		$4.85
POWER EQUIPMENT OPERATOR - OILER	AD	$34.50		$1.43
POWER EQUIPMENT OPERATOR - PAVER	AD	$23.00		$0.00
POWER EQUIPMENT OPERATOR - ROCK / STUMP TUB GRINDER	AD	$29.05	003	$12.10
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	$23.50		$2.50
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	$26.55		$13.67
POWER EQUIPMENT OPERATOR - SCRAPER	AD	$32.00	005	$9.55
POWER EQUIPMENT OPERATOR - SCREED	AD	$30.93	005	$10.87
POWER EQUIPMENT OPERATOR - SHOULDER MACHINE	AD	$26.09	003	$12.10
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	$30.18		$13.67
POWER EQUIPMENT OPERATOR - SPREADER	AD	$33.27	003	$15.82
POWER EQUIPMENT OPERATOR - TRIMMER	AD	$27.21	005	$0.00
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	$32.50		$15.55
RESILIENT FLOOR	AD	$32.08		$14.39
ROOFER/WATERPROOFER	AD	$32.26		$14.71
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	AD	$44.37		$22.75

SPRINKLERFITTER	AD	$38.67		$24.91
STEAMFITTER/PIPEFITTER	AD	$42.62		$23.19
STONE MASON	AD	$42.06		$19.91
TILE & TERRAZZO FINISHER	AD	$26.80		$11.67
TILE & TERRAZZO MECHANIC	AD	$32.31		$12.75
TRUCK DRIVER - A FRAME	AD	$24.22	027	$0.00
TRUCK DRIVER - DUMP	AD	$22.00		$11.21
TRUCK DRIVER - DUMP - ARTICULATING	AD	$27.97	005	$0.81
TRUCK DRIVER - FLATBED	AD	$26.00		$0.00
TRUCK DRIVER - LOWBOY	AD	$25.75	005	$11.96
TRUCK DRIVER - TACK/TAR TRUCK	AD	$44.20	003	$0.00
TRUCK DRIVER - TANDEM	AD	$22.00	027	$10.06
TRUCK DRIVER - WATER	AD	$18.00	005	$0.00

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds $250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

(AD) 17-209 Annual Determination from Survey Wage Data Received
(CH) 17-211 Commissioners' Hearing
(CR) 17-208 Commissioners' Review
(SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see http://www.census.gov/datamap/fipslist/AllSt.txt

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dllr.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

END OF REPORT

SECTION 011000 - SUMMARY

1.GENERAL

1. PROJECT INFORMATION

A. Project Identification: St Francis Neighborhood Center Addition.

Project Location: 2405 Linden Ave, Baltimore, MD 21217

B. Owner: St Francis Neighborhood Center

St. Francis Neighborhood Center is a tax-exempt non-profit. Materials purchased are not subject to State sales tax. GC to use Owner's Tax ID number for the purchase of materials as permitted by law.

C. Developer: Episcopal Housing Corporation

3986 Roland Avenue, Baltimore, MD 21211

D. Architect: RM Sovich Architecture Inc.

1 Village Square, Suite 175, Baltimore, MD 21210

E. The Work consists of

This project is is located at 2405 LINDEN AVENUE | BALTIMORE, MD 21217

The project scope consists of renovations to an existing historic structure and an addition to a recent addition. The scope is best understood in this way:

RENOVATIONS

Renovations to the existing 2,906 SF structure (1,453 SF on two floors) includes replacing all windows on all floors (except on on the second floor, rear facing the addition.) with historically appropriate windows. Removal of the existing front porch superstructure, new concrete slab to infill the ramp, and new porch column and roof structure. New ADA ramp access to the front porch. New exterior lighting, entrance door and security system. The sprinkler system will need to be

Interior renovations to the first and second floors of the existing structure as indicated on the drawings including new structure supporting new HVAC unit in the attic, modifications to the layout of the existing interior rooms and new finishes, hardware , HVAC distribution, and lighting.

ADDITION

The 3,256 SF Addition includes 948 SF of classrooms on the second floor and 2,308 SF on the first floor.

The Addition includes a new covered entrance, Lobby, Hall, Office, and Multipurpose Room.

The construction is primarily a wood structure constructed on a slab-on-grade.

The Addition includes, new exterior brick and siding on wood framing, a TPO roof system, new windows and exterior doors, interior finishes, lighting, and HVAC.

The site Work for the project includes modifications to the existing SWM system, grading, landscape, paving, retaining walls, exterior stairs and hand rails, and relocating an existing water line to make room for the new addition foundation. As indicated on the civil engineering drawings.

F. Work by Owner: Not specified at this time.

G. OWNER-FURNISHED PRODUCTS: The following products will be furnished by Owner and shall be installed by Contractor as part of the Work:

H. ALTERNATES: N/A

I. UNIT PRICES:

1.a.

2. WORK RESTRICTIONS

A. Contractor's Use of Premises: During construction, Contractor will have full use of site, building and area indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas to limit compaction in the constructed area.
2. Coordinate the use of on street parking locations for deliveries and subcontractors' vehicles with Owner and neighboring residents at project preconstruction meeting.

B. On-Site Work Hours: As required to complete the project.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

2.PRODUCTS (Not Used)

3.EXECUTION (Not Used)

END OF SECTION 011000

SECTION 01 14 00 - WORK RESTRICTIONS

1.GENERAL

1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2. USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to areas indicated in the scope of Work.
2. Owner Occupancy: No owner occupancy during the construction.
3. Coordinate construction schedule of Work with Owner's representation on site.

a. The existing building will be vacated throughout the construction process.

4. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

3. OCCUPANCY REQUIREMENTS

A. Architect will prepare a Certificate of Substantial Completion for the Work before Owner occupancy.

B. Contractor to obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.

C. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

2.PRODUCTS (Not Used)

3.EXECUTION (Not Used)

END OF SECTION 01 14 00

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

GENERAL

NOT FOR PROFIT OWNER

St. Francis Neighborhood Center is a tax-exempt non-profit. Materials purchased are not subject to State sales tax. GC to use Owner's Tax ID number for the purchase of materials as permitted by law.

ALLOWANCES

Advise Architect of the date when selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

Purchase products and systems selected by Architect from the designated supplier.

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

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.

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 Contract Sum and not part of the allowance.

UNIT PRICES

Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as] a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

Unit prices include all necessary material, plus cost for delivery, installation, insurance, [applicable taxes,]overhead, and profit.

Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

ALTERNATES

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 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.

The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

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

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.

Notification: Immediately following award of the Contract, notify each party involved, in writing, whether alternates have been accepted, rejected, or deferred for later consideration.

PAYMENT PROCEDURES

Submit a Schedule of Values at least seven (7) days before the initial Application for Payment. Break down the Contract Sum into at least one line item for each Specification Section in the Project Manual table of contents. Coordinate the schedule of values with Contractor's construction schedule.

Arrange schedule of values consistent with format of AIA Document G703.

Round amounts to nearest whole dollar; total shall equal the Contract Sum.

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.

Provide separate line items in the schedule of values for initial cost of materials and for total installed value of that part of the Work.

Provide a separate line item in the schedule of values for each allowance.

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

Submit three (3) copies of each application for payment according to the schedule established in Owner/Contractor Agreement.

Notarize and execute by a person authorized to sign legal documents on behalf of Contractor.

With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

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.

Include insurance certificates, proof that taxes, fees, and similar obligations were paid, and evidence that claims have been settled.

Include affidavit of payment of debts and claims on AIA Document G706.

Include affidavit of release of liens on AIA Document G706.

Include consent of surety to final payment on AIA Document G707.

Submit final meter readings for utilities, a record of stored fuel, and similar data as of the date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PRODUCTS (Not Used)

EXECUTION

SCHEDULE OF ALLOWANCES

1. Refer to Section 01 10 00 Summary for Alternates

SCHEDULE OF UNIT PRICES

1. Refer to Section 01 21 00 Summary for Allowances

SCHEDULE OF ALTERNATES

1. No Alternates proposed.

END OF SECTION 01 20 00

SECTION 01 21 00 - ALLOWANCES

1.GENERAL

1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2. SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

B. Allowances:

1. Provide an allowance for replacement of four trees to be removed due to construction disturbance.

C. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

2. Division 1 Section "Unit Prices" for procedures for using unit prices.

3. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

3. SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

4. SUBMITTALS

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

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

5. CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

6. TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

7. UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

2.PRODUCTS (Not Used)

3.EXECUTION

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.

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.

END OF SECTION 01210

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

1.GENERAL

1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2. SUMMARY

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

B. Related Sections include the following:

1. Division 1 Section "Allowances" for procedural requirements for handling and processing allowances.
2. Division 1 Section "Unit Prices" for administrative requirements for using unit prices.
3. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

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, "Architect's Supplemental Instructions.".

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. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 21 days 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 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 unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the 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 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.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: For Change Order proposals, use the AIA forms identified in Section 00 60 00 - PROJECT FORMS—- AIA Document G701, "Change Order."

5. ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. 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 margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

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. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.

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.

6. CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

7. CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

2.PRODUCTS (Not Used)

3.EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

1.GENERAL

1. PROJECT MANAGEMENT AND COORDINATION

A. Subcontract List: Submit a written summary identifying individuals or firms proposed for each portion of the Work.

B. Key Personnel Names: Within Fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. List e-mail addresses and telephone numbers.

C. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.

D. Requests for Information (RFIs): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Use forms acceptable to Architect and Owner.

E. Project Web Site: Use Architect's Drop-Box for the purposes of hosting and managing project communication and documentation until Final Completion.

F. Schedule and conduct progress meetings at Project site at biweekly intervals. Notify Owner and Architect of meeting dates and times. Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.

1. Record minutes and distribute to everyone concerned, including Owner and Architect.

2. SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.

B. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

1. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal.
2. 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 re-submittals.
3. Submit three copies of each action submittal. Architect will return two copies.
4. Submit two copies of each informational submittal. Architect will not return copies.
5. Architect will return submittals, without review, received from sources other than Contractor.
6. Initial Review: Contractor must indicate he has reviewed the submittal with a stamp prior to submitting to Architect. Allow 10 business days for Architect's initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
7. Direct Transmittal to Consultant: Where agreed in advance that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Contractor.
8. If intermediate submittal is necessary, process it in same manner as initial submittal. Allow 7 business days for processing each re-submittal.

C. Paper Submittals: Place a permanent label or title block on each submittal for identification. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect. Include the following information on the label:

1. Project name.
2. Date.
3. Name and address of Contractor.
4. Name and address of subcontractor or supplier.
5. Number and title of appropriate Specification Section.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with unique identifier, including project identifier, Specification Section number, and revision identifier.
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

E. Identify options requiring selection by Architect.

F. Identify deviations from the Contract Documents on submittals.

G. Contractor's Construction Schedule Submittal Procedure:

1. Submit required submittals in the following format:

    a. Working electronic copy of schedule file, where indicated.
    b. PDF electronic file.

c. One paper copy.

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

a. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

3. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

2.PRODUCTS

1. SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Architect's Drop-Box site specifically established for Project.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Submit electronic submittals via email as PDF electronic files.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. ACTION SUBMITTALS

A. Submit one (1) paper copies of each submittal over 10 pages unless otherwise indicated.

B. Product Data: Mark each copy to show applicable products and options. Include the following:

1. Manufacturer's written recommendations, product specifications, and installation instructions.
2. Wiring diagrams showing factory-installed wiring.
3. Printed performance curves and operational range diagrams.
4. Testing by recognized testing agency.
5. Compliance with specified standards and requirements.

3. 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. Submit on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (762 by 1067 mm). Include the following:

A. Dimensions and identification of products.
B. Fabrication and installation drawings and roughing-in and setting diagrams.
C. Wiring diagrams showing field-installed wiring.
D. Notation of coordination requirements.
E. Notation of dimensions established by field measurement.

4. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include name of manufacturer and product name on label.

   A. If variation is inherent in material or product, submit at least [three] <Insert number> sets of paired units that show variations.

2.INFORMATIONAL SUBMITTALS

1. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.

2. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

3. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

3.DELEGATED DESIGN SERVICES

1. 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.

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

2. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit [three] <Insert number> copies of 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.

   A. 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.

4.CONTRACTOR'S CONSTRUCTION SCHEDULE

1. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type schedule within 10 days of date established for commencement of the Work.

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

3. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

4. Recovery Schedule: When periodic update indicates the Work is fourteen (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, and equipment required to achieve compliance, and indicate date by which recovery will be accomplished.

3.EXECUTION

1. SUBMITTAL REVIEW

A. 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. Architect will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp, and will mark stamp appropriately to indicate action.

C. 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.

D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

2. CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Construction schedule must link issuance of submittals with construction schedule.

B. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at regularly scheduled progress meeting.

1. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribute copies of approved schedule to Owner, Architect, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties.

END OF SECTION 01 30 00

SECTON 01 40 00 (SECTION 01400) - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Administrative and procedural requirements for quality-control services, including inspections, tests, and reports performed by Contractor.

2. Administrative and procedural requirements for coordination, pre-construction and progress meetings.

B. Related Sections

1. 01 41 00 –Regulatory Requirements: Information related to compliance with environmental regulations.
2. 01 91 00 – Commissioning: Systems to be commissioned and procedures for commissioning.

1.2 PRE-CONSTRUCTION MEETING

A. Minimum agenda:

1. Environmental requirements and procedures.

a. Solid Waste Management Plan.

b. IAQ Management Plan.

c. Procedures for noise and acoustics management.

d. Environmental Management Plan.

e. Environmental Regulatory Requirements.

2. Commissioning: Third Party by Owner

3. Independent Verification:

a. Submittal documentation and data necessary for **Baltimore City Green Building** building rating program.

1.3 PROGRESS MEETINGS

A. Minimum agenda:

1. Review environmental requirements and procedures. Review status of Solid Waste Management IAQ Management Plan, and Environmental Management Plan.

2. Commissioning.

3. Independent Verification:

a. Submittal documentation and data necessary for **Baltimore City Green Building Program**

1.4 COORDINATION

A. Coordination:

1. Coordinate activities included in various Sections to assure efficient and orderly installation of each component. Coordinate operations included under different Sections that are dependent on each other for proper installation and operation.

a. Interior finishes: Schedule construction operations with consideration for indoor air quality.

b. Commissioning: The project will have selected building systems commissioned as specified in Section 01 91 00 (01810) – Commissioning. Coordinate prefunctional tests and start-up testing with commissioning.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 41 00 QUALITY REQUIREMENTS REGULATORY REQUIREMENTS

SECTION 01 42 00 - REFERENCES

1.GENERAL

1. GENERAL REQUIREMENTS

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

B. Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association

AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AHRI	Air-Conditioning, Heating, and Refrigeration Institute, The
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	Association of the Wall and Ceiling Industry
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
CCC	Carpet Cushion Council

CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet and Rug Institute (The)
CRRC	Cool Roof Rating Council
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau

CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal

GSI	Geosynthetic Institute
HI	Hydronics Institute
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
IAPSC	International Association of Professional Security Consultants
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers Association, Inc.
ICPA	International Cast Polymer Association
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISA	Instrumentation, Systems, and Automation Society, The
ISO	International Organization for Standardization

	Available from ANSI
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA (Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LGSEA	Light Gauge Steel Engineers Association
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MCA	Metal Construction Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)

NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCMA	National Concrete Masonry Association
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NOMMA	National Ornamental & Miscellaneous Metals Association

NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SCAQMD	South Coast Air Quality Management District
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association

SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SIA	Security Industry Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
TCNA	Tile Council of North America, Inc.
TEMA	Tubular Exchanger Manufacturers Association
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society

TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN Deutsches Institut fur Normung

IAPMO International Association of Plumbing and Mechanical Officials

ICC International Code Council

ICC-ES ICC Evaluation Service, Inc.

DIN Deutsches Institut fur Normung e.V.

IAPMO International Association of Plumbing and Mechanical Officials

ICC International Code Council

ICC-ES ICC Evaluation Service, Inc.

2.PRODUCTS (Not Used)

3.EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

1.GENERAL

1. SECTION REQUIREMENTS

A. Use Charges: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.

B. Water and Electric Power: Available from Owner's existing system without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Erosion- and Sedimentation-Control Plan: Submit plan showing compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

E. Accessible Temporary Egress: Comply with applicable provisions in ICC A117.1.

2.PRODUCTS

1. MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts and top and bottom rails.

B. Wood Enclosure Fence: Plywood, [6 feet (1.8 m)] [8 feet (2.4 m)] high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

2. TEMPORARY FACILITIES

A. Provide field offices, storage and fabrication sheds, and other support facilities as necessary for construction operations. Store combustible materials apart from building.

3. EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of [8] <Insert number> at each return-air grille in system and remove at end of construction.

3.EXECUTION

1. 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. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

C. Heating and Cooling: Provide temporary heating/cooling required 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.

D. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

2. SUPPORT FACILITIES INSTALLATION

A. Install project identification and other signs in locations approved by Owner to inform the public and persons seeking entrance to Project.

B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

C. Temporary Elevator Use: Use of existing elevators is not permitted; see Section 142400 "Hydraulic Elevators" for temporary use of new elevators.

D. Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

3. SECURITY AND PROTECTION FACILITIES INSTALLATION

A. 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.

B. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

C. 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.

D. 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 environmentally safe materials.

E. Furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. 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.

H. Provide floor-to-ceiling dust proof partitions to limit dust and dirt migration and to separate areas occupied by staff and tenants from fumes and noise.

I. Install and maintain temporary fire-protection facilities. Comply with NFPA 241.

4. MOISTURE AND MOLD CONTROL

A. Before installation of weather barriers, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

1. Protect stored and installed material from flowing or standing water.
2. Remove standing water from decks.
3. Keep deck openings covered or dammed.

B. After installation of weather barriers but before full enclosure and conditioning of building, protect as follows:

1. Do not load or install drywall or porous materials into partially enclosed building.
2. Discard water-damaged material.
3. Do not install material that is wet.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

5. 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. 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.

C. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

1.GENERAL

1. SECTION REQUIREMENTS

A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.

1. Show compliance with requirements for comparable product requests.
2. Architect will review the proposed product and notify Contractor of its acceptance or rejection.

C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.

D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.

E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
4. Store materials in a manner that will not endanger Project structure.
5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

F. Warranties specified in other Sections shall 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.

2.PRODUCTS

1. PRODUCT SELECTION PROCEDURES

A. Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at the time of installation.

1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
2. Where products are accompanied by the term "as selected," Architect will make selection.
3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:

1. Products:

a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.

2. Manufacturers:

a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.
b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.

3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.

C. Where Specifications require "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.

D. Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or 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. COMPARABLE PRODUCTS

A. Architect will consider Contractor's request for comparable product when the following conditions are satisfied:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.
3. List of similar installations for completed projects, if requested.
4. Samples, if requested.

3.EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

1.GENERAL

1. EXECUTION REQUIREMENTS

A. Certificates: Submit certificate signed by professional engineer, licensed in the State of Maryland, certifying that location and elevation of improvements comply with requirements.

B. Cutting and Patching:

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

2. CLOSEOUT SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

C. Operation and Maintenance Data: Submit two copies of manual.

D. PDF Electronic File: Assemble manual into a composite electronically indexed file. Submit on digital media.

E. Record Drawings: Submit one (1) set of marked-up record prints.

F. Record Digital Data Files: Submit data file and one (1) set(s) of plots.

G. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

3. SUBSTANTIAL COMPLETION PROCEDURES

A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

B. Submittals Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:

1. 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 sections, including project record documents, operation and maintenance manuals, property surveys, similar final record information, warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in other sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect.
4. Submit test/adjust/balance records.
5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Advise Owner of changeover in heat and other utilities.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Remove temporary facilities and controls.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

4. FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting inspection for determining final completion, complete the following:

1. Submit a final Application for Payment.

2. 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 shall state that each item has been completed or otherwise resolved.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

2.PRODUCTS

1. MATERIALS

A. 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.

B. 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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

2. OPERATION AND MAINTENANCE DOCUMENTATION

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system.

C. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Include the following:

1. Manufacturer's operation and maintenance documentation.
2. Maintenance and service schedules.
3. Maintenance service contracts. Include name and telephone number of service agent.
4. Emergency instructions.
5. Spare parts list and local sources of maintenance materials.
6. Wiring diagrams.

7. Copies of warranties. Include procedures to follow and required notifications for warranty claims.

3. RECORD DRAWINGS

A. Record Prints: Maintain a set of prints of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. Mark to show actual installation where installation varies from that shown originally. Accurately record information in an acceptable drawing technique.

1. Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings.

1. Format: Annotated PDF electronic file.

3.EXECUTION

1. EXAMINATION AND PREPARATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

B. 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.

1. Verify compatibility with and suitability of substrates.
2. Examine roughing-in for mechanical and electrical systems.
3. Examine walls, floors, and roofs for suitable conditions.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Take field measurements as required to fit the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.

E. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

2. CONSTRUCTION LAYOUT AND FIELD ENGINEERING

A. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks.

B. Engage a professional engineer to lay out the Work using accepted surveying practices.

C. Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project.

1. At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3. 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. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
3. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations.

C. 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.

D. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed.

E. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place. 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.

F. 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.

G. Use products, cleaners, and installation materials that are not considered hazardous.

4. CUTTING AND PATCHING

A. Provide temporary support of work to be cut.

B. 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.

C. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

D. Cutting: Cut in-place construction using methods least likely to damage elements retained or adjoining construction.

1. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

E. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in a manner that will minimize evidence of patching and refinishing.
2. 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.
3. 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. Provide additional coats until patch blends with adjacent surfaces.

5. CLEANING

A. Clean Project site and work areas daily, including common areas. Dispose of materials lawfully.

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.
3. Remove debris from concealed spaces before enclosing the space.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
2. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
3. Remove labels that are not permanent.
4. Clean transparent materials, including mirrors. Remove excess glazing compounds.
5. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean.
6. Vacuum carpeted surfaces and wax resilient flooring.

7. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and foreign substances. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors.
8. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

6. OPERATION AND MAINTENANCE MANUAL PREPARATION

A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.

1. Prepare supplementary text if manufacturers' standard printed data are unavailable and where the information is necessary for proper operation and maintenance of equipment or systems.

C. 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.

7. DEMONSTRATION AND TRAINING

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:

1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.

END OF SECTION 01 70 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.GENERAL

1. SECTION REQUIREMENTS

A. Action Submittals:

1. Waste Management Plan: Submit plan within 30 (thirty) days of date established for commencement of the Work.

B. Informational Submittals:

1. Waste Reduction Progress Reports: Submit concurrent with each Application for Payment. Include total quantity of waste, total quantity of waste salvaged and recycled, and percentage of total waste salvaged and recycled.
2. Records of Donations and Sales: Receipts for salvageable waste donated or sold to individuals and organizations. . Indicate whether organization is tax exempt.
3. Recycling and Processing Facility Records: Manifests, weight tickets, receipts, and invoices.
4. Landfill and Incinerator Disposal Records: Manifests, weight tickets, receipts, and invoices.
5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations.

C. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013000 "Administrative Requirements." Review methods and procedures related to waste management.

E. Waste Management Plan: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

1. Salvaged Materials for Reuse: Identify materials that will be salvaged and reused.
2. Salvaged Materials for Sale: Identify materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: Identify materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

2.PRODUCTS

1. PERFORMANCE REQUIREMENTS

A. Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work.

3.EXECUTION

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. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

2. SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Clean salvaged items and install salvaged items to comply with installation requirements for new materials and equipment.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Clean salvaged items and store in a secure area until delivery to Owner.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

3. RECYCLING WASTE

A. General: Recycle paper and beverage containers used by on-site workers.

B. 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.

C. Asphaltic Concrete Paving: Grind asphalt to maximum 4-inch (100-mm) size.

D. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

E. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch (100-mm) size.

F. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 4-inch (100-mm) size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

G. Wood Materials:

1. Sort and stack reusable members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
2. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
3. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

H. Metals: Separate metals by type.

I. Roofing: Remove and dispose of membrane, nails, staples, and accessories.

J. 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.

K. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

L. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

M. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

N. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

O. Conduit: Reduce conduit to straight lengths and store by type and size.

4. DISPOSAL OF WASTE

A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

B. Do not burn waste materials.

END OF SECTION 01 74 19

SECTION 02230 - SITE CLEARING

1.GENERAL

1. SUMMARY

A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

2. MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

3. PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Notify utility locator service for area where Project is located before site clearing.

2.PRODUCTS

1. SOIL MATERIALS

A. Satisfactory Soil Materials: As specified in Division 2 Section "Earthwork."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

3.EXECUTION

1. PREPARATION

A. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

D. Restore damaged improvements to their original condition, as acceptable to Owner.

2. TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3. UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

B. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted. Arrange to provide temporary utility services.

C. Excavate for and remove underground utilities indicated to be removed.

4. CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

5. TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

6. SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

7. DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

SECTION 02300 - EARTHWORK

1.GENERAL

1. SUMMARY

A. This Section includes the following:

1. Preparing subgrades.
2. Excavating and backfilling.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Base course for asphalt paving.

2. DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

3. PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

2.PRODUCTS

1. SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups [GW, GP, GM, SW, SP, and SM] <Insert satisfactory soil groups>, or a combination of these group symbols; free of rock or gravel larger than [3 inches (75 mm)] <Insert size> in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 Soil Classification Groups [GC, SC, ML, MH, CL, CH, OL, OH, and PT] <Insert unsatisfactory soil groups>, or a combination of these group symbols.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Detectable Warning Tape: Polyethylene film warning tape encasing a metallic core, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.

3.EXECUTION

1. PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, freezing temperatures or frost, and other hazards created by earthwork operations. Provide protective insulating materials as necessary.

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. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

2. EXCAVATION

A. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Excavate for structures, pavements, and walks to indicated elevations and dimensions. Extend excavations for placing and removing concrete formwork, for installing services and other construction, and for inspections. Trim bottoms to required lines and grades to leave solid base to receive other work.

C. Excavate utility trenches to indicated gradients, lines, depths, and invert elevations of uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit.

1. Excavate trenches deeper than bottom of pipe elevation, 6 inches (150 mm) deeper in rock, 4 inches (100 mm) deeper elsewhere, to allow for bedding course. Hand excavate for bell of pipe.

D. Proof roll subgrades, before filling or placing aggregate courses, with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

F. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

G. Stockpile borrow materials and satisfactory soil materials, without intermixing, in shaped, graded, drained, and covered stockpiles. Stockpile soil materials away from edge of excavations and outside drip line of remaining trees.

3. BACKFILLS AND FILLS

A. Utility Trench Backfill: Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

1. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade.
2. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

B. Fill: Place and compact fill material in layers to required elevations.

C. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

D. Compaction: Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

E. Compact soil to not less than the following percentages of maximum dry [unit weight] [density] according to ASTM D [1557] [698]:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at [95] <Insert number> percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at [92] <Insert number> percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at [85] <Insert number> percent.

F. Grading: 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. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch (25 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).

G. Subbase and Base Courses: Under pavements and walks, place subbase course on prepared subgrade. Place base course material over subbase. Compact to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

H. Under slabs-on-grade, place drainage course on prepared subgrade. Compact to required cross sections and thickness to not less than [95] <Insert number> percent of maximum dry unit weight according to [ASTM D 698] <Insert test method>.

4. FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Allow testing agency to test and inspect subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved deg ree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

5. PROTECTION AND DISPOSAL

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

D. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02 36 10 - TERMITE CONTROL

1.GENERAL

1. SUMMARY

A. This Section includes soil treatment for termite control.

2. SUBMITTALS

A. Product Data: For each product indicated, including EPA-Registered Label.

B. Product certificates.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

3. QUALITY ASSURANCE

A. Applicator Qualifications: A pest control operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

4. WARRANTY

A. Soil Termiticide Special Warranty: Manufacturer's standard form, signed by applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered within five

years from date of Substantial Completion, re-treat soil and repair or replace damage caused by termite infestation.

2.PRODUCTS

1. TERMITE CONTROL

A. Soil Treatment: EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent. Use only soil treatment solutions that are not harmful to plants.

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cyanamid Co.; Agricultural Products Group; Specialty Products Department.
b. Bayer Corp.; Garden & Professional Care.
c. DowElanco.
d. FMC Corp.; Pest Control Specialties.
e. Zeneca Professional Products.

3.EXECUTION

1. PREPARATION

A. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

2. SOIL TREATMENT APPLICATION

A. Apply soil treatment at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

1. Mix termiticide solution to a uniform consistency.

2. Apply to produce a continuous horizontal and vertical termiticidal barrier or treated zone around and under building construction. Distribute the treatment evenly.
3. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
4. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
5. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
6. Masonry: Treat voids.
7. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02 36 10

SECTION 02 41 00 - SELECTIVE DEMOLITION

1.GENERAL

1. SECTION REQUIREMENTS

A. Items indicated to be removed and salvaged remain Owner's property. Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner[ready for reuse]. Include fasteners or brackets needed for reattachment elsewhere.

B. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements. Submit before Work begins.

C. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

D. It is not expected that hazardous materials will be encountered in the Work. If hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

2.PRODUCTS

1. PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with EPA regulations and with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

3.EXECUTION

1. DEMOLITION

A. Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Before proceeding with demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the building.

B. Locate, identify, shut off, disconnect, and seal or cap off indicated utility services and mechanical/ electrical systems serving areas to be selectively demolished.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

D. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

E. Protect walls, ceilings, floors, and other existing finish work that are to remain. Erect and maintain dustproof partitions. Cover and protect furniture, furnishings, and equipment that have not been removed.

F. 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.

G. Provide temporary weather protection to prevent water leakage and damage to structure and interior areas.

H. Requirements for Building Reuse:

1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

I. 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.

J. Remove demolition waste materials from Project site[and legally dispose of them in an EPA-approved landfill]. Do not burn demolished materials.

K. 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 02 41 00

SECTION 02 41 20 CUTTING AND PATCHING

1.GENERAL

1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2. SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Division 7 Section "Through-Penetration Fire-stop Systems" for patching fire-rated construction.
3. Divisions Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

    a. Requirements in this Section apply to mechanical and electrical installations. Refer to mechanical and electrical sections and the Documents for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

3. DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

4. SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

5. QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.
8. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

a. Processed concrete finishes.
b. Ornamental metal.
c. Matched-veneer woodwork.
d. Preformed metal panels.
e. Roofing.
f. Fire-stopping.
g. Wall covering.
h. HVAC enclosures, cabinets, or covers.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

6. WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

2.PRODUCTS

1. MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

3.EXECUTION

1. EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

2. PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing 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.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3. PERFORMANCE

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 existing 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. Cutting: Cut existing 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 as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 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.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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.
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 existing 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, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

END OF SECTION 02 41 20

SECTION 04 20 00 - UNIT MASONRY

1.GENERAL

1. SECTION REQUIREMENTS

A. Concrete Masonry Units.

B. Exterior Brick

C. See Structural Drawings for furnishing steel lintels and shelf angles for unit masonry.

D. Submittals:

1. Samples for colored mortar for interior exposed surfaces.
2. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements.

2.PRODUCTS

1. UNIT MASONRY

A. Comply with ACI 530.1/ASCE 6/TMS 602.

2. MASONRY UNITS

A. Concrete Masonry Units: Refer also to Structural Drawings.

A. Concrete Masonry Units: ASTM C 90; Density Classification, **Normal Weight**.

1. Integral Water Repellent:
2. Products: One of the following:

a. ACM Chemistries; RainBloc.
b. BASF Aktiengesellschaft; Rheopel Plus.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

3. Special shapes for lintels, corners, jambs, sash, control joints, and other special conditions.
4. **Square-edged** units for outside corners.

3. MORTAR AND GROUT

A. Mortar: ASTM C 270, proportion specification.

1. Colored Mortar: For exterior exposed faces use colored cement or cement-lime mix of color to match Architect's sample.

B. Grout: ASTM C 476 with a slump of 8 to 11 inches (200 to 280 mm)

C. Refractory Mortar: Ground fireclay mortar or other refractory mortar that passes ASTM C 199 test and is acceptable to authorities having jurisdiction.

4. REINFORCEMENT, TIES, AND ANCHORS

1. Refer to Structural Drawings.

5. EMBEDDED FLASHING MATERIALS

A. Laminated Flashing: Copper sheet 7 oz./sq. ft. (2 kg/sq. m), bonded with asphalt between two layers of glass-fiber cloth. Use only where flashing is fully concealed.

1. Products: One of the following:

a. Advanced Building Products Inc.; Copper Fabric Flashing
b. Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
c. Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
d. Phoenix Building Products; Type FCC-Fabric Covered Copper.
e. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
f. York Manufacturing, Inc.; Multi-Flash 500.

6. MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded strips complying with ASTM D 1056, Grade 2A1.

B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; made from styrene-butadiene rubber or PVC.

C. Weep Holes: Free-draining polyethylene mesh, full height and width of head joint.

D. Cavity Drainage Material: Free-draining polymer mesh, full depth of cavity with dovetail shaped notches that prevent mortar clogging.

1. Products: One of the following:

a. Advanced Building Products Inc.; Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

E. Proprietary Acidic Masonry Cleaner: Product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

1. Manufacturers: One of the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

3.EXECUTION

1. INSTALLATION, GENERAL

A. Cut masonry units with saw. Install with cut surfaces and, where possible, cut edges concealed.

B. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

D. Stopping and Resuming Work: Rack back units; do not tooth.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

F. Build non-load-bearing interior partitions full height and install compressible filler in joint between top of partition and underside of structure above.

G. Tool exposed joints slightly concave when thumbprint hard unless otherwise indicated.

H. Keep cavities clean of mortar droppings and other materials during construction.

I. Set firebox brick in full bed of refractory mortar with full head joints. Make joints approximately 1/8 inch (3 mm) wide and tool smooth.

J. Set clay flue liners in full beds of refractory mortar to comply with ASTM C 1283.

2. LINTELS

A. Install lintels where indicated.

B. Minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3. FLASHING AND WEEP HOLES

A. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

B. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing before covering with mortar.

1. Extend flashing 4 inches (100 mm) into masonry at each end and turn up 2 inches (50 mm) to form a pan.

C. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

4. FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections required by authorities having jurisdiction.

1. Inspections: Level 2 special inspections according to the IBC.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

5. CLEANING

A. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly cured, clean exposed masonry.

1. Wet wall surfaces with water before applying acidic cleaner, then remove cleaner promptly by rinsing thoroughly with clear water.
2. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 20 00

SECTION 04 21 10 BRICK MASONRY

1.GENERAL

1.1. SECTION INCLUDES

A. Moulded clay masonry units and accessories for the following applications:
   1. Facing brick.

1.2. RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry.

1.3. REFERENCES

A. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

B. Brick Industry Association (BIA) Technical Notes on Brick Construction 20 - Cleaning Brickwork.

1.4. SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Samples: Furnish not less than five individual brick as samples, showing extreme variations in color and texture.

D. Sample Panel: Mock-up or sample panels shall be used to review brick and mortar color and serve as the standard of workmanship for the Project.
   1. Approximately 4 feet (1.2 m) long by 3 feet (1 m) high, showing the proposed color range, texture, bond, mortar and workmanship. All brick shipped for the sample shall be included in the panel.
   2. When required, provide a separate panel for each type of brick or mortar.
   3. Do not start work until Architect/Engineer has accepted sample panel.
   4. Use panel as standard of comparison for all masonry work built of same material.
   5. Do not destroy or move panel until work is completed and accepted by Architect.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years manufacturing similar products.

B. Installer Qualifications: Minimum 2 years installing similar products.

C. Certificates: Prior to delivery, submit to Architect/Engineer certificates attesting compliance with the applicable specifications for grades, types or classes included in these specifications.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store brick off the ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.

C. Cover all materials with a nonstaining waterproof membrane material when necessary to protect from elements.

D. Store different types of materials separately.

1.7. PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

2.PRODUCTS

2.1. MANUFACTURERS

A. Acceptable Manufacturer: Sioux City Brick, Belair Road Supply, PO Box 551, Riderwood, MD. 21139 (443 677-9888

B. Acceptable Manufacturer: US BRICK 701 East Bay St, Suite 112, Charleston SC, 29403

1. Ironspot/Norman size Brown/Tan acceptable option

C. Acceptable Manufacturer: Substitutions: Not permitted.

2.2. FACE BRICK

A. Facing Brick: ASTM C 216, Grade SW, Type FBA.
1. Size: **Norman 2293: 2-1/4 x 3-5/8 x 11-5/8 inches.**
2. Color: 50%: Red with Ironspot
3. Color: 50% Sienna

B. Special Shapes: N/A

C. All brick supplied shall be blended on site

2.3. PERFORMANCE REQUIREMENTS

A. Minimum Compressive Strength (ASTM C 216 and ASTM C 902): 5000 psi.

B. Maximum Initial Rate of Absorption (IRA) (ASTM C 216 and ASTM C 902): 50 g/min/30 sq.in.

C. Maximum Absorption, 24 Hour Submersion in Cold Water (ASTM C 216 and ASTM C 902): 10 percent.

D. Efflorescence (ASTM C 216 and ASTM C 902): Not Effloresced.

E. Abrasion Resistance (ASTM C 216 and ASTM C 902): 0.15.

3.EXECUTION

3.1. EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions for handmade brick using Bricklayer's Method.
   1. Do not use the tile setter's method where grout is floated into joints.
   2. Do not use polymeric sand or sand mixed with cement.
   3. Do not pressure wash handmade brick pavers. If cleaning is required, use a medium bristle brush and water.
   4. Do not use vibratory compactors.
   5. Do not use muriatic acid based cleaners on handmade brick pavers, especially those with a lime coating, for example, Savannah Grey, Georgetown, and Brunswick.
   6. Do not seal brick pavers with a sealer coating

B. Lay masonry with full head and bed joints.

C. Lay all brick plumb and true to lines.

D. When adjustment is necessary to be made after mortar begins to harden, remove hardened mortar and replace with fresh mortar.

3.4. BONDING

A. Lay masonry in bond pattern as indicated on drawings or general notes.
   1. Reference BIA Technical Note #30 for additional requirements.

3.5. TOOLING AND POINTING

A. Joint Profile: Tool mortar joints to a concave appearance.

B. Joint Profile: Tool mortar joints to a concave V-shaped appearance.

C. Joint Profile: Tool mortar joints to a concave grapevine appearance.

D. Tool exposed joints when "thumb-print" hard.

E. Flush cut all joints not tooled.

F. When pointing, rake mortar joints to a depth of not less than 1/2 inch (12 mm). Fill solidly with pointing mortar. Tool joints.

3.6. CLEANING

A. Clean in accordance with Manufacturer's instructions and as outlined in BIA Technical Notes 20.

B. Do not use wire brush or pressure wash. Bucket and brush cleaning is recommended.

C. Use products approved by brick manufacturer.

D. Cut out all defective mortar joints and holes in exposed masonry and provide new mortar.

E. Clean pre-selected sample wall area. Do not proceed with cleaning until approved by Architect.

F. All cleaning practices and product used shall be in accordance with cleaning products manufacturer's printed instructions.

3.7. PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 06100 - ROUGH CARPENTRY

1.GENERAL

1. SUMMARY

A. This Section includes the following:

a) Wood framing.
b) Wood supports.
c) Wood blocking.
d) Wood cants.
e) Wood nailers.
f) Wood furring.
g) Wood grounds.
h) Wood sheathing.
i) Wood subflooring.
j) Wood underlayment.
k) Plywood backing panels.
l) Building wrap.

2. SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product indicated.

1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.

C. Research/Evaluation Reports: For the following:

a) Treated wood.
b) Engineered wood products.
c) Foam-plastic sheathing.
d) Power-driven fasteners.
e) Powder-actuated fasteners.
f) Expansion anchors.
g) Metal framing anchors.
h) Building wrap.

2.PRODUCTS

1. MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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 manufacturers specified.

b) Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2. WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

a) Factory mark each piece of lumber with grade stamp of grading agency.

b) For exposed lumber indicated to receive stained or natural finish, mark grade stamp on end or back of each piece.

c) Provide dressed lumber, S4S, unless otherwise indicated.

d) Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. 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.

a) Allowable Design Stresses: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Wood Structural Panels:

a) Plywood: DOC PS 1.

b) Oriented Strand Board: DOC PS 2.

c) Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."

3. WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

4. FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and] AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

a) Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
b) Use treatment that does not promote corrosion of metal fasteners.
c) Use Exterior type for exterior locations and where indicated.
d) Use Interior Type A High Temperature (HT), unless otherwise indicated.

5. DIMENSION LUMBER

A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade and the following species:

a) Mixed southern pine; SPIB.

C. Framing Other Than Non-Load-Bearing Partitions: Construction, Stud, or No. 2grade and of the following species:

a) Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; NLGA, WCLIB, or WWPA.
b) Southern pine; SPIB.

D. Exposed Framing: Hand select material for uniformity of appearance and freedom from characteristics that would impair finish appearance.

a) Species and Grade: Southern pine, Select Structural grade; SPIB.

6. ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Composite of wood veneers with grain primarily parallel to member lengths, manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.

a) Manufacturers:

i. Boise Cascade Corporation.
ii. Georgia-Pacific Corporation.
iii. Louisiana-Pacific Corporation.
iv. Pacific Woodtech Corp.
v. Trus Joist MacMillan.
vi. Union Camp Corp.; Building Products Division.
vii. Willamette Industries, Inc.

b) Extreme Fiber Stress in Bending, Edgewise: per Structural Drawings
c) Modulus of Elasticity, Edgewise: per Structural Drawings

B. Wood I-Joists: Prefabricated units complying with APA PRI-400; depths and performance ratings not less than those indicated.

a) Manufacturers:

i. Boise Cascade Corporation.
ii. Georgia-Pacific Corporation.

iii. Louisiana-Pacific Corporation.
iv. Pacific Woodtech Corp.
v. Poutrelles International Inc.
vi. Standard Structures Inc.
vii. Stark Truss Company, Inc.
viii. Superior Wood Systems, Inc.
ix. Trus Joist MacMillan.
x. Union Camp Corp.; Building Products Division.
xi. Willamette Industries, Inc.

b) Web Material: Plywood, Exposure 1.

c) Structural Capacities: Establish and monitor structural capacities according to ASTM D 5055.

d) Trademark: Factory mark I-joists with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and I-joist compliance with APA standard.

C. Rim Boards: Performance-rated product complying with APA PRR-401.

a) Per Structural Drawings

7. SHEATHING

A. Integrated Plywood Wall Sheathing/Building Wrap: ZIP WALL SHEATHING SYSTEM.

B. Plywood Roof Sheathing: Exterior, Structural I sheathing.

8. SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

9. PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

10. MISCELLANEOUS MATERIALS

A. Fasteners:

a) Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

b) Power-Driven Fasteners: CABO NER-272.

c) Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

a) Manufacturers:

i. Alpine Engineered Products, Inc.
ii. Cleveland Steel Specialty Co.
iii. Harlen Metal Products, Inc.
iv. KC Metals Products, Inc.
v. Silver Metal Products, Inc.
vi. Simpson Strong-Tie Company, Inc.
vii. Southeastern Metals Manufacturing Co., Inc.
viii. United Steel Products Company, Inc.

b) Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.

c) Allowable Design Loads: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Building Wrap: Zip®Sheathing System

D. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.

E. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in sheathing and recommended by sheathing manufacturer for use with type of sheathing required.

F. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

G. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

3.EXECUTION

1. INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

a) Published requirements of metal framing anchor manufacturer.
b) Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
c) Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
d) Table 2306.1, "Fastening Schedule," in the Standard Building Code.
e) Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.

D. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

E. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

F. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

G. Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

a) Comply with "Code Plus" provisions in above-referenced guide.

H. Fastening Methods:

a) Refer to Structural Drawings

I. Apply building paper horizontally with 2-inch (50-mm) overlap and 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails. Cover upstanding flashing with 4-inch (102-mm) overlap.

J. Building Wrap Application: Install per Zip System Wall Sheathing Manufacturer's Requirements.

K. Apply sheathing tape to joints between sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 06100

SECTION 06150 - WOOD DECKING

GENERAL

1. SUMMARY

A. This Section includes solid-wood roof and floor decking.

2. SUBMITTALS

A. Product Data:

3. QUALITY ASSURANCE

A. Decking Standard: Comply with AITC 112, "Standard for Tongue-and-Groove Heavy Timber Roof Decking."

4. DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.

PRODUCTS

1. LUMBER, GENERAL

A. Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies.

B. Grade Stamps: Factory mark with grade stamp of inspection agency on surfaces that will not be exposed to view.

2. SOLID WOOD DECKING

A. Wood Species: Douglas fir-larch, Southern pine .

B. Moisture Content: Provide wood decking with 15 percent maximum moisture content at time of dressing.

C. Pattern and Dressing: Tongue and groove, edge yee one side, surfaced two sides.

3. FABRICATION

A. Fabricate decking in lengths for controlled random lay-up.

EXECUTION

1. INSTALLATION

A. Solid Wood Decking: Install to comply with referenced decking standard. Apply joint sealant between decking and supports and between tongues and grooves at outside wall supports.

a) Fasten per structural drawings.

B. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by Architect.

C. Provide temporary waterproof covering to protect exposed decking before applying roofing.

END OF SECTION 06150

SECTION 06 25 00 WOOD REPAIRS

PART 1. GENERAL

1.1 RELATED DOCUMENT S

Drawings and general provisions of the contract, including

General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.2 WORK INCLUDED

Provide labor, materials and equipment necessary to complete the work of this Section including, but not limited to the following:

1. Removal of exterior finish systems at areas of wood restoration or repair
2. Preservation and sealing of seams and joints
3. Removal of decayed and contaminated wood
4. Installation of borate wood preservatives
5. Installation of wood repair compound materials

Extent of wood restoration work is as indicated on the drawings and as specified herein.

1.3 SUBMITTA LS

General Submit the following according to Conditions of Contract and Division I Specification Sections Product data, installation instructions, and general recommendations from manufacturer for types of repair required including technical data sheets defining performance properties.

Restoration Schedule: Submit schedule for each window, door, cornice, or area of wood trim to be restored, outlining in detail proposed restoration work to be performed on each component.

Obtain written approval from Architect prior to commencement of repair work.

Certification that materials comply with local VOC limitations.

Qualification data for firms and persons specified in the “Quality Assurance” article to demonstrate their capabilities and experience.

1. Five (5) business days after bid opening, submit a written qualification and experience of all lead personnel for work on the Project. List project manager or foreman's name and experience relative to this Project.

2. All work shall be performed by persons whose qualifications have been submitted and approved.

1.4 QUALITY ASSURANCE

A. Restorations Specialist: Work must be performed by a firm having not less than (5) years successful experience in comparable wood restoration work including work on at least three (3) buildings listed in the National Register of Historic Places under the direction of federal and state preservation agencies in the last five (5) years and employing personnel skilled in the restoration process and operations indicated.

1. Restoration Specialist firm must be acceptable to, or certified by, manufactured of primary restoration materials.

2. Work associated with work of this section, including (but limited to) paint removal and substrate preparation, is to be performed by Installer of the work.

3. Only skilled workers who are thoroughly trained and experienced in wood repairs and restoration work at areas as noted, have the skills required for the work of this section, and are completely familiar with the materials and methods specified shall be used for wood restoration work.

4. At least one skilled worker shall be present at all times during the execution of the work and shall personally direct the wood repairs and restoration work.

5. In acceptance or rejection of the wood restoration work, no allowance will be made for lack of skill on the part of the workers.

B. Field Mock-ups

1. Wood Restoration: following the requirements of the Section, perform a mock-up of each type of wood repair system specified to demonstrate materials and methods intended to be used in the finished work.

   a) perform mock-ups in areas indicated by the Architect.

b) obtain the Architect's written approval of each mock-up before proceeding with the work of the Section

c) protect the approved mock-ups until the completion of all the Work

d) Approved mock-up shall represent the minimum acceptable standard for each type and detail of the restoration work.

C. Manufacturer: Obtain primary repair materials from a single manufacturer. Provide secondary materials as recommended by the manufacturer of the primary materials.

1.5 DELIVERY STORAGE AND HAND LING

A. Deliver all materials in original unopened containers labeled with the manufacturer's name, brand name, item name and installation instructions.

B. Store materials in compliance with the manufacturer's requirements for temperature, maximum and minimum, and other conditions. Keep all materials under cover and dry. Protect against exposure to the weather.

C. Discard and remove from the job site any materials damaged in handling or storage and any materials that have been subjected to conditions contrary to the manufacturer's recommendations or whose maximum shelf life has expired.

1.6 PROJECT CONDITION S

A. Lead: Existing paint may contain lead. Take all necessary precautions to ensure the safety of all persons engaged in removing lead-based paint and dispose of all residues generated from lead-based paint stripping in a legal manner in accordance with all local, state and federal codes.

B. Coordination: Coordinate wood repair with paint stripping so that the effected surfaces are exposed for a minimal time to avoid further damage to bare wood. Coordinate with painting so that all restored surfaces are primed as soon as possible after repair.

C. Weather: Proceed with the work of this section only when existing and foreseen weather conditions permit the work to be performed in accordance with the manufacturer's recommendations for temperature and humidity range, minimum and maximum.

D. Substrate Conditions: Do not proceed with product applications until substrates have been inspected and are determined to be in satisfactory conditions. Substrate moisture content shall not be in excess of 18°/0 during preparation and application

Remove all decayed wood to a clean, sound, unaffected substrate
Remove all built up paints, and other debris to a clean sound substrate.
Remove all wood sawdust to a clean sound substrate.

E. Protection:

1. Use all necessary means to protect interior of building from all damage caused by precipitation and other environmental conditions during the work of the Section

2. Protect all adjacent building surfaces from damage, staining or deterioration resulting from wood restoration work.

3. Protect the restoration work in progress to prevent further deterioration exposed wood surfaces. Protect the completed work until the time of final inspection and acceptance by the architect.

F. Safety: General Contractor shall use all means necessary to ensure that no person (whether involved in the work of the Section or not) is harmed or injured due to the work of this Section. Comply with all applicable laws codes and regulations.

G. Security: Coordinate work with the owners project manager to ensure that the building is secured at the end of each work period. Review security procedures with the Owner prior to proceeding with the work in this Section. coupling/bonding agent

PART 2- PRODUCTS

2.1 GENERAL

Compatibility: provide products recommended by the manufacturers to be fully compatible with indicated substrate.

2.2 EPOXY REPAIR PRODUCTS

Epoxy repair materials shall consist of 2 separate systems, a 2 part low viscosity epoxy primer/ coupling agent and a 2 part thixotropic paste meeting the criteria of Table A and B.

2.3 MANUFACTURER OF REPAIR PRODUCTS AND EQUIPMENT

Manufacturer: Subject to compliance with the requirements, provide product of the following or approved equal.
1. Advanced Repair Technology, Cherry Valley, NY
2. Window Care Systems, Pembroke, MA
3. or approved equal

2.4 REPAIR PRODUCTS

1. Low viscosity epoxy coupling/bonding agent

2. Epoxy repair compound

3. Injectable Borate gel

4. Borate rods

2.5 PAINT STRIPPERS

A. Chemical Stripping Agent. Methylene chloride based, Thixotropic stripper

B. Products: Subject to compliance with requirements, provide the following, or approved equal

1. 509 Stripper

2. ProSoCo

3 or approved equal

C. Low Temperature heat gun or heat plate, no open flame.

PART 3-EXECUTION

3.1 INSPECTION

A. Inspect all wood surfaces in conjunction with the Architect to determine the extent of restoration and methods to be used.

1. The Architect's decision regarding the extent of required repair, and extent of profile replication work shall be final.

2. In wood surfaces where decay is present, determine the methods and treatment of repair.

3. Areas that do not attach existing profiles, determine the level of restoration and replication to be achieved.

B. Joints, Joinery and edges: Check wood members at joints, seamsand edges for:

1. Any open seams or failed conditions.

2. Wood moisture content.

3. The presence of wood decay, by probing surfaces.

C. Sills and Trim

1. Inspect wood surfaces for natural defects (knots) cracks and checks.

2. Determine wood moisture content.

3. Probe for the presence for wood decay.

3.2 REMOVAL

A. Removal of Finishes:

1. Remove all peeling and loose paint by scraping. Taking care not to damage sound wood and profiles.

2. Strip all painted wood surface to bare wood, taking care not to damage sound wood and profiles by the application of stripping paste or by the use of a heat gun or plate

a) Remove stripper and finishes as directed by manufacturer.

b) Dispose of debris in accordance with approved methods.

3. Wash all surfaces with recommended neutralizing agents to remove any foreign particle, dust and chemical residue, allow surface to thoroughly dry.

3.3 PREVENTATIVE SYSTEMS

A. Preservation and Sealing of seams and joints. Repair of wood 'checking' due to weathering

1. Open or failed seams and checks shall be dilated to a width of 3/16" and depth of 1/2"

2. Remove all decayed, soft and weathered wood.

3. Check the moisture content and hardness of wood at and around the repair, maximum allowable moisture content 18°/0.

4. Sand bare wood to remove all loose fibers, paint, compounds. Remove all sawdust and dirt.

5. Pre-treat bare and sanded wood thoroughly with low viscosity epoxy coupling/bonding agent

6. Allow coupling agent to penetrate wood surface for a minimum of 10 minutes and maximum of 30 minutes, or as recommended by the manufacturer. Avoid applying in direct sunlight

7. Remove any excess bonding agent with absorbing paper

8. Apply epoxy repair compound over epoxy bonding agent while still tacky.

9. Epoxy compound shall have optimal contact with wood

10. Avoid inclusion of air pockets during application

11. Fill joints full, even and smooth in one application

12. Allow full cure time as specified by manufacturer before application of paint or varnish.

13. After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding

14. If required, smooth any remaining irregularities with an additional application of epoxy repair compound. Always sand between coats.

3.4 CURATIVE SYSTEMS

A. Preservation and Repair of Damaged/Decayed Wood:

1. Remove all paint and other coatings from area to be repaired.

2. Remove all decayed soft and discolored wood, to sound bright unaffected material

3. Check area of removal to determine complete elimination of decayed material.

a) Remaining wood should be even color without red-brown and/or gray spots.

b) No soft wood, existing brittle compound, or other previous repair materials should remain.

4. Check moisture content and hardness of the wood in and around the repair area

a) Moisture content of wood to be 18°/0 or less

5. Sand bare wood to remove all loose fibers, paint, compounds. Remove all sawdust and dirt.

6. Drill holes in effected area to receive borate gel and rods. Follow manufacturer's dose recommendations for dimensional lumber.

7. Inject recommended dose of borate gel. Gel should not come in contact with exposed wood surface.

8. Install borate rod in same hole as gel. Gel should not come in contact with exposed wood surface.

9. Pre-treat bare and sanded wood thoroughly with low viscosity epoxy coupling/bonding agent.

a) Allow coupling/bonding agent to penetrate wood surface for a minimum of 10 minutes and maximum of 30 minutes, or as recommended by the manufacturer. Avoid applying in direct sunlight

b) Remove any excess bonding agent with absorbing paper.

10. Apply epoxy repair compound over the uncured epoxy coupling agent.

a) Epoxy fill shall have optimal contact with wood

b) Avoid inclusion of air pockets during application

c) Fill joints fill, even and smooth in one application

d) Allow full cure time as specified by manufacturer before preparing for finishes.

11. After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding.

12. If required, smooth any remaining irregularities with an additional application of epoxy repair compound. Always sand between coats.

3.5 ADJUSTMENTS

A. Repair or replace all defective work at no additional cost to the owner.

End of Section

Architectural Wood Columns Section: 06 40 00

1.0 GENERAL

1.1. PRODUCT DESCRIPTION

A. Basis of Design: Column shaft shall be standard tongue and groove construction by Melton Classics according to Design No.Tuscan #200TN
B. Column will have the correct proportions based on Orders of Architecture.
C. Lumber species shall be Clear All Heart Redwood

1.2 SUBMITTALS

A. Submit Product Literature and shop drawings for customer approval.

B. Submit samples of cap, base, and column shaft

1.3 DELIVERY, STORAGE AND INSTALLATION

A. Storage and installation of shafts, capitals and bases shall be according to manufacturer-supplied instructions.
B. Columns must be stored in a dry, well-ventilated area that is not exposed to heat or sunlight.

1.4 WARRANTY

A. Manufacturer shall furnish a ten-year warranty that its Cedar or Clear All Heart Redwood columns with fiberglass capitals, bases and plinths will be free of manufacturing defects, joint separation and rotting.
B. Manufacturer shall furnish a one year warranty on all other wood species against manufacturing defects.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

Basis of Design:

A. Melton Classics, Inc.
P.O. Box 465020
Lawrenceville, Georgia 30042-5020
(770) 963-3060 ~ (800) 963-3060 ~ FAX (770) 962-6988
Website: www.MeltonClassics.com
Email: Sales@MeltonClassics.com

2.2 MATERIALS

A. All glue joints shall be glued under pressure using Type I waterproof glue and allowed to cure for a minimum of twenty-four hours.
B. All columns shall be primed with two coats of primer and hand sanded between coats. Exterior columns shall be coated on the interior with asphaltum paint.
C. Capitals, bases and plinths for lower orders in exterior application shall be load-bearing fiberglass and shall be furnished with lead flashing as required.
D. N/A
E. Plinths shall be made of load-bearing fiberglass for exterior use.
F. N/A

G. Column shafts shall be manufactured from 2 inch nominal thickness lumber stock.

3.0 EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's detailed installation guidelines.

SECTION 06 16 00 - SHEATHING (ZIP System Sheathing)

1.GENERAL

1. SUMMARY

A. Section Includes

1. Wall sheathing with integral water-resistive barrier and air barrier.

2. REFERENCES

A. American Society of Mechanical Engineers (ASME): www.asme.org

1. ASME B18.6.1 - Wood Screws (Inch Series)

B. ASTM International (ASTM): www.astm.org

1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
3. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings
4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
5. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

C. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355

1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

D. International Code Council (ICC): www.iccsafe.org

1. ICC IBC - International Building Code
2. ICC IRC - International Residential Code for One- and Two-Family Dwellings

E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org

1. AC38 – Acceptance Criteria for Weather Resistive Barriers

2. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
3. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
4. ICC-ES AC201 - Acceptance Criteria for Staples
5. ICC-ES AC266 - Acceptance Criteria for Wood Structural Panel Roof Sheathing Factory-Laminated with an Alternate Roof Underlayment
6. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
7. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
8. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction

F. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/

1. SFI 2010 - 2014 Standard

3. ACTION SUBMITTALS

A. Product Data: For each type of sheathing product specified.

4. INFORMATIONAL SUBMITTALS

A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICCES AC266 and ICC-ES AC310.

5. CLOSEOUT SUBMITTALS

A. Warranty: Executed copy of manufacturer special warranties.

6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.

B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.

7. DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

8. WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.

1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

2.PRODUCTS

1. MANUFACTURERS

A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com; www.huberwood.com

2. PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Exterior Fire-Test Exposure: ASTM E108, Class A, when covered with approved Class A coverings.
2. Fire-Resistance Ratings: Where indicated, provide assemblies tested for fire resistance per ASTM E119.

B. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.

C. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

D. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

3. WOOD PANEL PRODUCTS

A. Single Source Limitations: Provide wall sheathing by a single manufacturer.

B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

4. WALL SHEATHING WITH INTEGRAL WATER-RESISTIVE BARRIER AND AIR BARRIER

A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing with factory-laminated water-resistive barrier facer with printed fastener location symbols.

1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System Sheathing.
2. Span Rating, Panel Grade and Performance Category: Not less than [24/16; Rated Sheathing; 7/16 Performance Category] [24/16; Structural 1; 7/16 Performance Category] [32/16; Structural 1; 1/2 Performance Category] [40/20; Structural 1; 5/8 Performance Category].
3. Edge Profile: [Square edge] [Self-spacing].
4. Facer: Medium-density, phenolic-impregnated sheet material qualifying as a Grade D weather-resistive barrier in accordance with ICC AC38.

a. Provide fastener spacing symbols on facer for 16-inch (406 mm) and 24-inch (610 mm) on center spacing.

5. FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.

1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A153M [or Type 304 stainless steel.

B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

D. Wood Screws: ASME B18.6.1.

6. SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC-ES AC148, and tested as part of an assembly meeting performance requirements.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape.
2. Thickness: 0.012 inch (0.3 mm).

B. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing/weather barrier and self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendation for integration with ZIP System Tape.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Liquid Flash.
2. Hardness, Shore A, ASTM C 661: 40 to 45.

3.EXECUTION

1. EXAMINATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

2. SHEATHING INSTALLATION

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant sequencing and installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs. Support all panel edges.

1. Space square-edged panels 0.125 inch (3 mm).
2. Butt edges of self-spacing edge panels.
3. IBC: Table 2304.9.1 Fastening Schedule.

E. Apply ZIP System Tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

F. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with ZIP System Tape.

END OF SECTION

SOLID SURFACING FABRICATIONS 06 61 16

1.GENERAL

1.1. SUMMARY

A. Section Includes: Provide solid surfacing fabrications including but not limited to following:

1. window sills.
2. millwork counter tops.

B. Related Sections: Following description of work is included for reference only and shall not be presumed complete:

1. General Requirements.
2. Product Requirements.
3. Waste Management and Disposal.
4. Indoor Air Quality Requirements.
5. Architectural Woodwork.
6. Joint Sealants.
7. Tiling.
8. Provision of plumbing and plumbing fixtures

1.2. REFERENCES

A. Abbreviations and Acronyms:

1. MDF: Medium Density Fiberboard.
2. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.
3. VOC: Volatile Organic Compound.

B. Definitions:

1. Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

C. Reference Standards:

1.	ANSI/NPA A208.2-09	- Medium Density Fiberboard (MDF) For Interior Applications
2.	ASTM C920-14a	- Standard Specification for Elastomeric Joint Sealants
3.	ASTM D638-10	- Standard Test Method for Tensile Properties of Plastics
4.	ASTM D785-08	- Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
5.	ASTM D790-10	- Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6.	ASTM D5420-10	- Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
7.	ASTM E84-14	- Standard Test Method for Surface Burning Characteristics of Building Materials
8.	ASTM E228-11	- Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer

9.	ASTM G21-13	- Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
10.	ASTM G22-76(96)	- Standard Practice for Determining Resistance of Plastics to Bacteria
11.	ASTM G155-13	- Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
12.	CSA B45.5-11/ IAPMO Z124-2011	- Plastic Plumbing Fixtures
13.	NFPA 255-06	- Standard Method of Test of Surface Burning Characteristics of Building Materials
14.	NSF/ANSI 51-07	- Food Equipment Materials
15.	SCAQMD Rule 1168	- Adhesive and Sealant Applications (amended January 2005)
16.	UL 723	- Standard for Test for Surface Burning Characteristics of Building Materials
17.	UL Environment/ GREENGUARD UL 2818	- Standard for Chemical Emissions for Building Materials, - Finishes and Furnishings, Section 7.1
18.	UL Environment/ GREENGUARD UL 2818	- Gold Standard for Chemical Emissions for Building Materials, - Finishes and Furnishings, Section 7.1 and 7.2
19.	UL 2824	- GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers

1.3. ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Architect. Presided over by Contractor, include Architect who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.4. SUBMITTALS

A. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colors, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.

B. Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.

C. Coordination Drawings: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.

D. Samples: Submit samples in accordance with Section 01 30 00. Submit minimum 6" x 6" samples. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

1.5. CLOSEOUT SUBMITTALS

A. Operational and Maintenance Data:

1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
2. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

1.6. QUALITY ASSURANCE

A. Qualifications:

1. Installers: Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

B. Mock-Ups:

1. Prior to final approval of Shop Drawings, erect 1 full size mock-up of each component at Project site demonstrating quality of materials and execution for Architect review.
2. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from Project site.
3. Approved mock-up will be used as standard for acceptance of subsequent work.
4. Approved mock-ups may remain as part of finished work.

1.7. DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.

B. Storage and Handling Requirements:

1. Store components indoors prior to installation.
2. Handle materials to prevent damage to finished surfaces.

1.8. WARRANTY

A. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

2.PRODUCTS

2.1. MANUFACTURERS

A. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

1. Corian® by DuPont; www.corian.com
2. Samsung Chemical USA; www.staron.com
3. Wilsonart Contract; www.wilsonartcontract.com

B. Substitution Limitations: This Specification is based on Corian® Products. Comparable Products from manufacturers listed herein will be accepted provided they meet requirements of this Specification.

2.2. MATERIALS

A. Performance/Design Criteria:

	Property	Requirement (min or max)	Test Procedure
1.	Solid Surface Based Products:		
a.	Tensile Strength	6000 psi min	ASTM D638
b.	Tensile Modulus	1.5 x 10^6 psi min	ASTM D638
c.	Tensile Elongation	0.4% min.	ASTM D638
d.	Flexural Strength	10000 psi min	ASTM D790
e.	Flexural Modulus	1.2 x 10^6 psi min	ASTM D790
f.	Hardness	>85-Rockwell "M" scale min.	ASTM D785
g.	Thermal Expansion	2.2 x 10^{-5} in./in./°F	ASTM E228
h.	Fungi and Bacteria	Does not support microbial growth	ASTM G21 & G22
i.	Microbial Resistance	Highly resistant to mold growth	UL 2824
j.	Ball Impact	No fracture - 1/2 lb. Ball: 6 mm slab - 36" drop 12 mm slab - 144" drop	NEMA LD 3, Method 3.8
k.	Weatherability	ΔE*94<5 in 1,000 hrs	ASTM G155
l.	Flammability		ASTM E84, NFPA 255 & UL 723

		All Colors		
		6 mm	12 mm	
m.	Flame Spread	<25	<25	
n.	Smoke Developed	<25	<25	
o.	Class	A	A	NFPA 101®, Life Safety Code

D. Solid Surface Material:

E. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:

F. Flammability: Class 1 and A when tested to UL 723.

G. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.

H. Sealant: A standard mildew-resistant, FDA/UL® recognized silicone color matched sealant or clear silicone sealants.

2.3. COMPONENTS

A. Window Sills: 1/2" thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Color selected later by Architect from manufacturer's full color range.

B. Counter Perimeter Frame: Ensure 3/4" thick, moisture resistant cores for counter tops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only. MDF core conforming to ANSI/NPA A208.2 balanced design, manufactured from recycled materials, meeting ANSI Standards for emissions, of minimum density of 48 lb/cu ft and surface character to match sample approved by Architect. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84.]

C. Lavatory Tops with Seamed Bowls: 1/2" thick countertop of 100% acrylic solid surfacing material, cast to desired profiles and sizes having edge details as indicated on Drawings conforming to CSA B45.5/IAPMO Z124, complete with bowl. Provide countertops complete with backsplashes of size shown on Drawings. Ensure countertop and backsplash is color; single color non-coved as selected by Architect.

D. Fabrication:

1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
2. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
3. Ensure no blistering, whitening and cracking of components during forming.
4. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colors may be fabricated by traditional means discussed in K-25294 *Backsplashe*s. Colors with metallic/mica particle or veined colors creating directional aesthetics (K-26833 *Directional Aesthetics*) may require the techniques in Technical Bulletin K-28235 *Thermoformed Backsplash*.
5. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint. Reinforcing strip of solid polymer material is not required when using DuPont™ Joint Adhesive 2.0.
6. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.

8. Finish: Ensure surfaces have uniform finish:

a. Matte, with a 60° gloss rating of 5 - 20.

9. Fabrication Tolerances:

a. Variation in Component Size: +/-1/8".
b. Location of Openings: +/-1/8" from indicated location.

3.EXECUTION

3.1. EXAMINATION

A. Verification of Conditions:

1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Verify actual site dimensions and location of adjacent materials prior to commencing work.
3. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0".
4. Notify Architect in writing of any conditions which would be detrimental to installation.

B. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. INSTALLATION

A. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.

B. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

C. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

D. Install countertops with no more than 1/8" sag, bow or other variation from a straight line.

E. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-coordinated silicone sealant. [Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.]

F. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.

G. Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-coordinated joint adhesive.

H. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Completion of the Work.

I. Coordinate connections of plumbing fixtures with [Division 22] [Mechanical]. Make plumbing connections to sinks in accordance with [Division 22] [Mechanical].

3.3. REPAIR

A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

3.4. SITE QUALITY CONTROL

A. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.5. CLEANING

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.6. PROTECTION

A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

B. Protect surfaces from damage until date of Substantial Completion of the Work.

END OF SECTION 06 61 16

SECTION 07 21 00 - THERMAL INSULATION

1.GENERAL

1. SECTION REQUIREMENTS

A. Submittals: Product Data and ICC-ES evaluation reports for foam-plastic insulation.

B. Surface-Burning Characteristics: According to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.PRODUCTS

1. INSULATION PRODUCTS

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with flame-spread and smoke-developed indexes of 75 and 450, respectively.

1. Manufacturers: One of the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

B. Foil-Faced Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1, with flame-spread and smoke-developed indexes of 75 and 450, respectively.

1. Manufacturers: One of the following:

a. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Rmax, Inc.

C. Glass-Fiber-Blanket Insulation: ASTM C 665, Type III, Class A, foil faced on one side with flame-spread and smoke-developed indexes of 25 and 450, respectively.

1. Manufacturers: One of the following:

a. CertainTeed Corporation.
b. Guardian Building Products, Inc.
c. Johns Manville.
d. Knauf Insulation.
e. Owens Corning.

D. Mineral-Fiber-Blanket Insulation: ASTM C 665, Type I, unfaced with flame-spread index of 25 or less.

E. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, and minimum density of 1.5 lb/cu. ft. (24 kg/cu. m).

1. Manufacturers: One of the following:

a. BASF Corporation.
b. BaySystems NorthAmerica, LLC.
c. Dow Chemical Company (The).
d. ERSystems, Inc.
e. Gaco Western Inc.
f. Henry Company.
g. NCFI; Division of Barnhardt Mfg. Co.
h. SWD Urethane Company.
i. Volatile Free, Inc.

2. ACCESSORIES

A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed to fit between roof framing members and to provide cross-ventilation between insulated attic spaces and vented eaves.

3.EXECUTION

1. INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

C. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

D. Except for loose-fill insulation and insulation that is friction fitted in stud cavities, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

E. Place loose-fill insulation to comply with ASTM C 1015.

1. Comply with the CIMA's Special Report #3, "Standard Practice for Installing Cellulose Insulation."

F. Spray-Applied Insulation: Apply insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs.

G. Install sheet radiant barriers according to ASTM C 1158.

H. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items with tape.

END OF SECTION 07 21 00

SECTION 07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of liquid-applied asphalt emulsion air/vapor barrier.

C. Application of materials to provide bridge and seal air leakage pathways in:

1. Wall and roof connections and penetrations.
2. Connections to foundation walls.
3. Walls, windows, curtain walls, storefronts, louvers or doors
4. Expansion and control joints.
5. Masonry ties.
6. All other penetrations through the wall assembly.

1.02 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry.

B. Section 07 21 00 - Thermal Insulation.

C. Section 07 50 00 - Membrane Roofing.

D. Section 07 60 00 - Flashing and Sheet Metal.

E. Section 07 70 00 - Roof and Wall Specialties and Accessories.

F. Section 07 80 00 - Fire and Smoke Protection.

G. Section 07 92 00 - Joint Sealants.

H. Section 08 10 00 - Doors and Frames.

I. Section 08 50 00 - Windows.

H. Section 09 20 00 - Plaster and Gypsum Board.

1.03 REFERENCES

ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E283-91 (1999) - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.=

G. ASTM E2178-01 - Standard Test Method for Air Permeance of Building Materials.

H. ASTM E2357 - 05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

QUALITY ASSURANCE

A. Installer Qualifications:

1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.

a. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: Convene one week prior to commencing Work of this section.

1.07 MOCK-UPS

A. Prior to installation of air/vapor barrier, apply air/vapor barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction and other termination conditions, as well as qualities of materials and execution.

B. Apply air barrier in field-constructed mock-ups of assemblies specified in Section 04 20 00 – Unit Masonry and Section 09 20 00 – Plaster and Gypsum Board.

C. Test mock-up in accordance with ASTM E783 and ASTM E1105 for air and water infiltration.

D. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air and vapor barrier membrane unless it has been inspected, tested and approved.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store at temperatures above 32o F (0o C), free from contact with cold or frozen surfaces.

D. Protect materials during handling and application to prevent damage or contamination.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not proceed with product application during rain or inclement weather.

C. Do not apply membrane when air or surface temperatures are below 30o F (-1o C).

D. Do not apply to frozen substrate.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Website www.wrmeadows.com. or pre approved equal.

2.02 MATERIALS

A. Liquid Air Vapor Barrier System: One-component, polymer-modified, cold-applied, liquid air/vapor barrier membrane.

1. Performance Based Specification: Air/vapor barrier membrane shall be an elastomeric asphalt emulsion having the following characteristics:
    a. Air Leakage ASTM E2357: 0.04 cfm / ft.2 @ 75 Pa (1.57 lb./ft.2).
    b. Air Permeability ASTM E2178: 0.004 cfm /ft.2 @ 75 Pa (1.57 lb./ft.2).
    c. Water Vapor Permeance ASTM E96 (Method B): ≤0.1 perms.
    d. Elongation ASTM D412: 1500 %.
    e. Tensile Strength ASTM D412: 15 psi.
2. Proprietary Based Specification: AIR-SHIELD LM by W. R. MEADOWS.

2.03 ACCESSORIES

A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).
    1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.

B. Liquid Flashing and Joint Sealant for exterior sheathing panels: Fluid -applied, single-component, flashing membrane for rough openings and detailing.
    1. AIR-SHIELD LIQUID FLASHING by W. R. MEADOWS.

C. Joint Tape: Self-adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).
    1. AIR-SHIELD by W. R. MEADOWS.

D. Membrane Adhesive:
    1. Temperatures above 40o F (4o C): Water-Based Adhesive
        a. MEL-PRIME™ W/B Water-Based Adhesive by W. R. MEADOWS.
    2. Temperatures below 30o F (-1o C): Solvent-Based Adhesive.
        a. MEL-PRIME Solvent-Based Adhesive by W. R. MEADOWS.

E. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
    1. POINTING MASTIC by W .R. MEADOWS.

F. Detailing Membrane: non-slump waterproofing material for joint detailing.
    1. BEM by W. R. MEADOWS.

G. Concrete Repair Materials: general purpose patching materials.
    .1 MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars by W. R. MEADOWS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air/vapor barrier.

B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities, and small deformities with cementitious patching mortar at least two hours before application.

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:

1. Install and fasten exterior sheathing panels according to the sheathing manufacturer's instructions.
2. Treat all countersunk and removed fasteners with joint filler or liquid flashing material.
3. Inspect the joint to ensure that all areas to receive joint treatment are clean, dry, smooth, and free from all bond-breaking contaminants.
4. Remove and replace any damaged structural wall components.
6. Joint Treatment with fluid applied membrane
    a. Fill joint area with fluid applied membrane using a spreader tool or putty knife.
    b. Apply fluid applied membrane extending beyond the joint line 3" onto face of exterior sheathing.
    c. Fully embed the reinforcing fabric 3" wide into the wet fluid applied membrane centered over the joint.
    d. Run the spreader tool or putty knife over the embedded reinforcing fabric to remove any air bubbles.

J. Plywood and Oriented Strand Board (OSB):

1. Install and fasten boards according to board manufacturer.
2. Apply membrane adhesive on either side of the joint extending 3" from the center.
3. Install a 4" (25.4 mm) strip of self-adhesive membrane centered over the joint and roll press firmly into place.
4. For joints width more than ¼" (6.4 mm), fill with detailing membrane prior to application of self-adhesive membrane.

3.03 APPLICATION OF AIR BARRIER SYSTEM

A. TRANSITION MEMBRANE

1. Condition surfaces to be covered in one working day with applicable adhesive.
2. Apply transition membrane with a minimum overlap of 3" onto primed surface at all joints, columns, beams, and dissimilar materials.
3. Roll membrane firmly into place.
4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
5. Overlap subsequent courses of membrane a minimum of 2" and ensure joints are fully adhered.
6. Seal top edge of transition membrane with pointing mastic.

B. ROUGH OPENING TRANSITION MEMBRANE

1. Fluid-Applied Transition Membrane using liquid flashing membrane
    a. Apply a coat of membrane adhesive on the raw edges of exterior gypsum board.

b. Treatment of joints or cracks larger than ¼" (6.35 mm) and less than ½" (12.7mm).
    i. Prefill any joints or cracks with the liquid flashing material.
    ii. Apply a generous bead of material over the joint.
    iii. Press and spread liquid flashing into the joint.
    iv. Allow material to skin over prior to full application of liquid flashing into the rough opening.

c. Treatment of joints or cracks larger than ½" (12.7 mm)
    i. Install backer rod into the joint to control depth of liquid flashing material.
    ii. Apply a generous bead of material over and into the joint.
    iii. Press and spread liquid flashing into the joint.
    iv. Smooth out using a spreader tool or putty knife
    v. Allow material to cure prior to full application of liquid flashing into the rough opening.

d. Apply a bead of liquid flashing in the rough opening starting at the top and continuing around the rough opening.

e. Spread the material using a spreader tool or putty knife across the rough opening surface.

f. Test the material thickness using a wet mil gauge to ensure that it has a thickness of 12-15 mils.

g. Apply a generous bead of liquid flashing material to the vertical surface around the rough opening and sprea this material 4" – 6" (100 – 152 mm) onto the vertical surface with a spreader tool or putty knife.

h. Test the thickness to ensure the material has a thickness of 12-15 mils.

j. Allow liquid flashing material to dry before installing any windows, doors, wall assembly, and full air barrier material.

B. THROUGH WALL FLASHING

1. Condition surfaces to be covered in one working day with applicable adhesive.
2. Remove release paper prior to application.
3. Apply though wall flashing at based of masonry walls as indicated on drawings.
4. Recess through wall flashing 1/2" (13 mm) from the face of the masonry.
5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.

C. AIR BARRIER MEMBRANE

1. Apply air/vapor barrier membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft.2/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 45 mils dry.
7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.04 PROTECTION

1. Cover air/vapor barrier membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION

SECTION 07 44 00. CONCRETE FACED PANELS

1. GENERAL

1. SUMMARY

A. Section Includes:
1. Insulating drainage panels.
2. Concrete faced insulated perimeter wall panels.

B. Related Requirements:
1. Division 01 - General Requirements: Administrative, procedural, and temporary work requirements.

2. REFERENCES

A. ASTM International (ASTM):
1. C518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. C947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading).
3. C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
4. D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between 30 176C and 30 176C With a Vitreous Silica Dilatometer.
5. D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
6. D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
7. D2394 - Standard Test Methods for Simulated Service Testing of Wood and Wood Base Finish Flooring.
8. D4716 - Standard Test Method for Determining the (In plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
9. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

3. ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
1. Convene at Project site 2 weeks prior to beginning work of this Section.
2. Attendance: Architect, Owner, Developer, Contractor, installer, and related trades.
3. Review: Project conditions, manufacturer requirements, delivery and storage, staging and sequencing, and protection of completed work.

4. SUBMITTALS

A. Action Submittals:
1. Product Data: Manufacturer's data sheets on each product to be used, including:
   a. Preparation instructions and recommendations.
   b. Storage and handling requirements and recommendations.
   c. Installation methods.
2. Samples:
   a. Color chips representing manufacturer's full range of available colors and patterns.
   b. After color selection submit 4 x 4 inch samples of each color and patterns.

5. QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience in work of this Section.

B. Manufacturer: Provides design, engineering, fabrication, and testing of required components and assemblies for complete system.

C. Mockup: Provide mockup for evaluation of surface preparation techniques and application workmanship.

6. DELIVERY, STORAGE AND HANDLING

A. Protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

B. Store panels flat.

C. Do not drop panels.

7. SITE CONDITIONS

A. Substrate and ambient air temperature in accordance with manufacturer's requirements.

8. WARRANTY

A. Manufacturer's standard year warranty against defects in materials and workmanship.

2. PRODUCTS

2.1. MANUFACTURERS

A. Contract Documents are based on products by T. Clear Corporation, 800-544-7398, email sconfer@tclear.com, www.tclear.com.

2.2. MATERIALS

A. Insulating Drainage Panels:
   1. Source: Thermadry Insulating Drainage Panels by T. Clear Corporation.
   2. Performance: Type 1250; 40 PSI:
      a. Thickness: 2 inches.
      b. R-value 9.4, tested to ASTM C518.
      c. Compressive strength: 3460 PSF, tested to ASTM D1621.
      d. Flow rate: 12 gallons per minute per foot at 500 PSF.
   3. Construction:
      a. Composite of insulation and fabric.
      b. Closely-spaced vertical and horizontal channels on one side of panel.
      c. Filtration fabric overlaps adjacent panels both vertically and horizontally.
   4. Size: 2 x 8 feet.
   5. Edges: Square.

B. Concrete Faced Insulated Perimeter Wall Panels:
   1. Source: WallGUARD Concrete Faced Insulated Perimeter Wall Panels by T. Clear Corporation.
   2. Construction:
      a. Extruded polystyrene board, ASTM C578, Type IV, rigid, closed cell, with integral high density skin, with integral 5/16 inch thick latex-modified concrete facing.

b. Board Size: 2 x 4 feet x 2-5/16 inches thick.
c. Edges: Tongue-and-groove sides, square ends.
d. thermal resistance: Long term aged R-value of 5 per inch, tested to ASTM C518.
e. Foam compressive strength: Minimum 35 PSI, tested to ASTM D1621.
f. Compressive strength: Minimum 40 PSI, tested to ASTM D 1621.
g. Water absorption: Maximum 0.7 percent by volume, tested ASTM D2842.
h. Water vapor permeance: 0.8, tested to ASTM E96/E96M.
i. Coefficient of lineal thermal Expansion: 3.5 x 10-5 inches per inch x degree F, tested to ASTM D696.

3. Accessories:
   a. Metal cap flashing: 24 gage galvanized steel J-channel; 2-1/4 inches wide, 4 inch long leg and 2-1/4 inch short leg; prefinished, color to be selected.

3. EXECUTION

3.1. INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

3.2. INSTALLATION OF INSULATING DRAINAGE PANEL

A. Foundation Wall Insulation:
   1. Surfaces to receive panels:
      a. Smooth, monolithic, free of coarse aggregate and debris.
      b. Waterproofing cured and free of solvent.
   2. Place mastic adhesive compatible with panels and waterproofing in six large, equally-spaced spots on non-fabric side of panels.
      a. Install first panel vertically, with long edge flush with corner and fabric flap on right.
      b. Place fabric flap on horizontal edge at bottom of panel and position to prevent backfill from entering channels.
      c. Ensure that fabric on long edge of panel overlaps previous panel.
      d. Continue until corner is reached. Cut and install corner panels.
      e. Use adhesive or staples to hold flap in place.
      f. Install additional loose filter fabric to ensure that gaps are covered.
   3. Multiple tier installation:
      a. Install in manner similar to that used on lower tier.
      b. Ensure that fabric flap of upper panels overlaps lower panels.
   4. Top edge finishing: If top edge of panels is below grade, seal edge to prevent soil entry using J or Z-shaped channel, sheathing tape, or soil fabric.
   5. Above grade installation: If panels extend above grade, protect exposed area from physical damage and ultraviolet exposure using mechanically attached protection.
   6. Connect panels to subsurface drainage system.

B. Plaza Deck Installation:
   1. After waterproofing membrane has been tested and approved, lay insulation panels loose over waterproofing, with fabric facing up.
   2. Fit joints tight, with fabric overlapped at side and end joints.
   3. Provide temporary ballast if installation of wearing surface is delayed.

3.3. INSTALLATION - CONCRETE FACED INSULATING SHEATHING

A. Steel and Wood Studs:
   1. Install sheathing horizontally with long dimension perpendicular to studs.
   2. Locate panel ship-lap joint on studs.

3. Fastener at 6 inches on center on panel joint and maximum 6 inches on center at intermediate studs if studs are 16 inches or less on center and 4-1/2 inches on center if studs are 24 inches on center.
4. Use self drilling, corrosion resistant screws with 5/8 inch pancake head with square or star drive head as provided by panel manufacturer.

B. Concrete and Masonry Substrates:
1. Place 1/4 inch beads of non-expanding urethane adhesive to foam side of panel along four outer edges and at 12 inches from long edge of panel running full length of panel.
2. Place corrosion-resistant masonry fasteners maximum 12 inches on center over entire panel surface.
3. Coat heads and panel joints with waterproofing compound supplied by panel manufacturer.

C. Seal joints with fiberglass mesh tape embedded in waterproofing compound supplied by panel manufacturer.

3.4. INSTALLATION - CONCRETE FACED INSULATED PERIMETER WALL PANELS

A. Surfaces to Receive Panels: Flat, sound, clean, and free from irregularities and or jagged surfaces.

B. Lay out panels to maximize board sizes. Do not use boards less than 6 inches wide.

C. Install panels in orientation to maximize full sheets.

D. Install fastening clips and cap flashings.

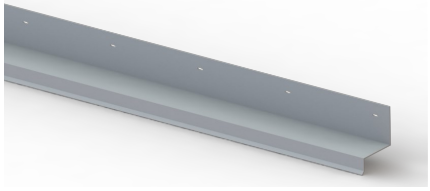
3.5. PROTECTION

A. Protect installed products from damage during construction.

Cap Flashing

For WallGUARD® Concrete Faced Insulated Perimeter Wall Panels

T. Clear Corporation is pleased to offer a **UV stable rigid PVC*** cap flashing designed specifically for WallGUARD Concrete Faced Insulated Perimeter Wall Panels. The use of PVC results in no thermal bridging so the flashing will not take away from the insulation value of the WallGUARD panels or the wall assembly. The PVC design includes a drip edge to keep water from running down the face of the panels as well as providing for an aesthetically pleasing gray color that closely matches the natural color of the concrete facing on the WallGUARD panels. The Styrofoam® insulation is completely covered to prevent any UV degradation which would affect the integrity of the WallGUARD panel over time. The flashing comes in 8' lengths with 3/16"x 1/2" holes every 6" to screw or nail to your substrate. When securing the flashing to the substrate with either screws or nails make sure you leave the connection loose (1/32") to leave room for the slight expansion and contraction of the PVC material.

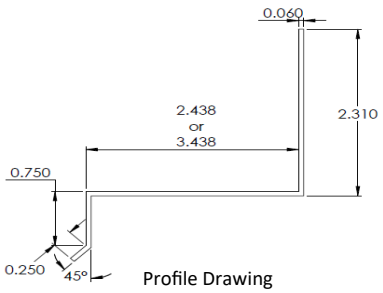


Part Dimensions	8' length (see profile dwg below)
Packaging **	(10) 8' pieces/Carton = 80 lf per Carton
Carton Dimensions & Weight	6"x6"x97" / 17 lbs Carton
Color	Gray
Fasteners	Not included

**Cap Flashing sold in Carton quantities only

Properties	Value	Test
Izod Impact, ft lbs/in notch	20.6	D-792
Tensile Yield Strength, 10^3 psi	6.5	D-256
Tensile Modulus, 10^5 psi	3.9	D-638
Flexural Yield Strength, 10^3 psi	12.7	D-790
Flexural Modulus, 10^5 psi	4.2	D-790
DTUL at 264 psi, °C Un-anneal	67	D-648
ASTM Cell Classification	16343	D-1784

*Rimtec 45005C is designed for production of weather-resistant rigid profile extrusions, where good color retention and impact resistance, even after prolonged outdoor exposure, are required.



Profile Drawing

T. Clear Corporation 3255 Symmes Road Hamilton, OH 45015 800-544-7398
www.tclear.com

END OF SECTION

SECTION 07 54 23 THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING / FULLY ADHERED SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install elastomeric sheet roofing system, including:
   1. Roofing manufacturer's requirements for the specified warranty.
   2. Removal of entire existing roof membrane and flashings.
   3. Removal of all existing insulation down to the deck.
   4. Preparation of roofing substrates.
   5. Wood nailers for roofing attachment.
   6. Insulation.
   7. Vapor retarder / air barrier.
   8. Elastomeric membrane roofing.
   9. Metal roof edging and copings.
   10. Flashings.
   11. Walkway pads. where indicated
   12. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.

C. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at http://manual.fsbp.com.

D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 REFERENCES

A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.

B. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.

C. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.

D. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2004.

E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.

F. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting; 2003.

G. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000.

H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2003.

I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

J. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.

K. FM 1-28 - Design Wind Loads; Factory Mutual System; 2002.

L. FM 1-29 - Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2005.

M. PS 1 - Construction and Industrial Plywood; 1995.

N. PS 20 - American Softwood Lumber Standard; 2005.

O. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2003. (ANSI/ SPRI ES-1).

1.03 SUBMITTALS

A. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
   2. Where UL or FM requirements are specified, provide documentation that shows that the roofing system to be installed is UL-Classified or FM-approved, as applicable; include data itemizing the components of the classified or approved system.

B. Samples: Submit samples of each product to be used.

C. Shop Drawings: Provide:
   1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

D. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

E. Executed Warranty.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Roofing installer shall have the following:
   1. Currently Approved Firestone contractor.
   2. At least five years' experience in installing specified system.

B. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   2. Notify Architect well in advance of meeting.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.06 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Warranty: Firestone 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
   1. Limit of Liability: No dollar limitation.
   2. Scope of Coverage: Repair leaks in the roofing system caused by:
      a. Ordinary wear and tear of the elements.
      b. Manufacturing defect in Firestone brand materials.
      c. Defective workmanship used to install these materials.
      d. Damage due to winds up to 55 mph (88 km/h).
   3. Not Covered:
      a. Damage due to winds in excess of 55 mph (88 km/h).
      b. Damage due hurricanes or tornadoes.
      c. Hail.
      d. Intentional damage.
      e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer - Roofing System: Firestone Building Products Co., Nashville, TN. www.firestonebpco.com.

B. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:

   1. Specializing in manufacturing the roofing system to be provided.

   2. Minimum ten years of experience manufacturing the roofing system to be provided.

   3. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.

   4. ISO 9001 certified.

   5. Able to provide polyisocyanurate insulation that is produced in own facilities.

C. Manufacturer of Insulation and Cover Board: Same manufacturer as roof membrane.

D. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
   1. Metal roof edging products by other manufacturers are not acceptable.
   2. Field- or shop-fabricated metal roof edgings are not acceptable.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:
   1. Membrane: Thermoplastic Polyolefin (TPO).
   2. Thickness: As specified elsewhere.
   3. Membrane Attachment: Fully adhered.
   4. Comply with applicable local building code requirements.
   5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
   6. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and 1-29, and meeting minimum requirements of FM 1-60 wind uplift rating.

B. Vapor Retarder Under Base Layer of Insulation:
   1. One Layer: woven tri-laminate high-density polyethylene top surface factory-laminated to SBS modified bitumen tape adhesive.

2. Attachment: Liner released adhesive attachment.

C. Insulation:
1. Total Roof Assembly R Value: 30, minimum.
2. Maximum Profile Thickness: 7.5 inches (191 mm).
3. Maximum Individual Board Thickness: 95 mm (3.75 inches); use as many layers as necessary; stagger joints in adjacent layers.
4. Base Layer: Polyisocyanurate foam board, non-composite.
   a. Attachment: Cold adhesive attachment.
5. Intermediate/Top Layer(s): Polyisocyanurate foam board, non-composite.
   a. Attachment: Cold adhesive attachment.

2.03 TPO MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
2. Sheet Width: Provide the widest available sheets to minimize field seaming.
3. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
4. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C 1549.
5. Color: White.
6. Acceptable Product: ULTRAPLY TPO or ULTRAPLY TPO FLEX ADHERED by Firestone

B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 457 mm (18 inches) wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
1. Thickness: 0.060 inch (1.52 mm) plus/minus 10 percent.
2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
5. Color: White.
6. Acceptable Product: ULTRAPLY TPO Flashing by Firestone.

E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing by Firestone.

F. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; ULTRAPLY Bonding Adhesive by Firestone.

G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing Pourable Sealer by Firestone

H. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

I. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.

J. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.

K. General Purpose Sealant: UltraPly TPO General Purpose Sealant by Firestone.

L. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.

M. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch (3 mm) by 30 inches (760 mm) by 40 feet (12.19 m) long with patterned traffic bearing surface; UltraPly TPO Walkway Pads by Firestone.

2.04 VAPOR RETARDER MATERIALS

A. Retarder Sheet: woven tri-laminate high-density polyethylene top surface factory-laminated to SBS modified bitumen tape adhesive.
1. Thickness: 0.030 inch (.76 mm) plus/minus 10 percent.
2. Tensile Strength: 64/88 lbf/in (11.3/15.4 kN/m), minimum, when tested in accordance with ASTM D 5147.
3. Ultimate Elongation MD/XD: 52/24 percent when tested in accordance with ASTM D 5147.
4. Tearing Strength MD/XD: 84/90 lbf (375/400 N) when tested in accordance with ASTM D 5601.
5. Water Vapor Permeance: 0.017 Perms (0.92 ng/Pa s m^2) when tested in accordance with ASTM E 96 (Proc. B).
6. Air Permeability: 0.00114 ft^3/min ft^2 (0.007 ng/L/sec m^2) when tested in accordance with ASTM D 1970 (75 Pa).
7. Acceptable Product: V-Force Vapor Barrier Material by Firestone.

2.05 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
1. Thickness: As indicated elsewhere.
2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
   a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
3. R-Value (LTTR):
   a. 1.0 inch (25 mm) Thickness: 6.0, minimum.
   b. 3.0 inch (76 mm) Thickness: 18.5, minimum.
4. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
7. Acceptable Product: Resista polyiso board insulation by Firestone mold resistant material per ASTM D3273)

Roof System will consist of:

1. **2x6 T+G Wood Plank Deck**
2. **1/2" Plywood**
3. **R.30 Insulation**
4. **TPO Roof Membrane 60 ml**
5. **At areas where access to equipment is indicated, provide additional 60 mil sheets**

B. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

2.06 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
   1. Wind Performance:
      a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
      b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
      c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
   2. Fascia Face Height: 5 inches (127 mm).
   3. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
   4. Fascia Material and Finish: 24 gage, 0.024 inch (0.06 mm) galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
   5. Length: 144 inches (3650 mm).
   6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
   7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
   8. Anchor Bar Cleat: 20 gage, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
   9. Curved Applications: Factory modified.
   10. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
   11. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
   12. Scuppers: Welded watertight.
   13. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
   1. Wind Performance:
      a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
      b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
   2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
   3. Material and Finish: 24 gage, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
   4. Dimensions:
      a. Wall Width: As indicated on the drawings.
      b. Piece Length: Minimum 144 inches (3650 mm).
      c. Curved Application: Factory fabricated in true radius.
   5. Anchor/Support Cleats: 20 gage, 0.036 inch (0.9 mm) thick prepunched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72 inches (1820 mm) on center.
   6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm)

long legs on corner, intersection, and end pieces.

7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners.

2.07 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
   1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
   2. Thickness: Same as thickness of roof insulation.

PART 3 INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Safety Data Sheets (SDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing man-

ufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Remove all of the existing roof system down to the roof deck including all existing composition base flashings. Dispose of all materials properly. Perform asbestos removal in accordance with federal, state and local regulations and dispose of waste in legal manner.
   1. At penetrations, remove all existing flashings, including lead, asphalt, mastic, etc.
   2. At walls, curbs, and other vertical and sloped surfaces, remove loose and unsecured flashings; remove mineral surfaced and coated flashings; remove excessive asphalt to provide a smooth, sound surface for new flashings.

B. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

C. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

D. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.

E. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 VAPOR RETARDER

A. Before installing insulation install vapor retarder directly over the deck.

B. Install retarder membrane by releasing the liner sheet from the integral SBS adhesive in accordance with the manufacturer’s prescribed conditions.

C. Overlap adjacent sheet runs 3 in. (75mm) and 6 in. (150mm) at end lap. Stagger end laps no less than 12 in. (300mm) between sheet runs.

D. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.

3.05 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install insulation in a manner that will not compromise the vapor retarder integrity.

C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

D. Lay roof insulation in courses parallel to roof edges.

E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

F. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.

G. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.06 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 1:6 (2 in 12 inches) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
   2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.07 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under the membrane anchorage leg.
   4. Flash with manufacturers recommended flashing sheet unless otherwise indicated.
   5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
   6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
   7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Existing Scuppers: Remove scupper and install new scupper.

D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
   3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
   4. Provide termination directly to the vertical substrate as shown on roof drawings.

F. Roof Drains:
   1. Existing Drains: Remove all existing flashings, drain leads, roofing materials and cement from the drain; remove clamping ring.
   2. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.

3. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
4. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
5. Apply sealant on top of drain bowl where clamping ring seats below the membrane
6. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.08 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1 inch (25 mm) and maximum of 3 inches (75 mm) from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.09 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07 71 01 - ROOF SPECIALTIES/ EDGE FALL PROTECTION

1.GENERAL

1. SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

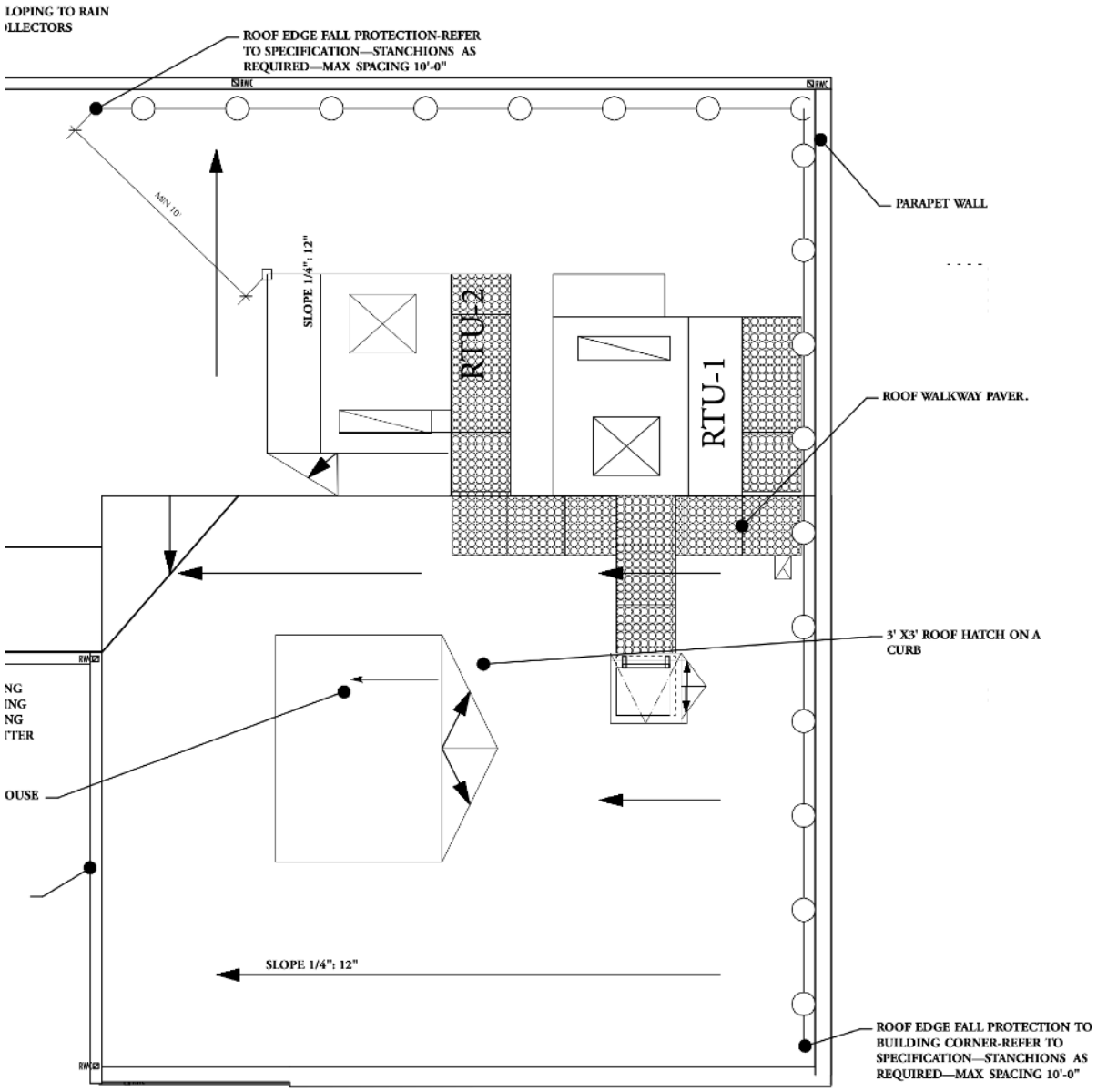
B. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

C. PRODUCTS:

Non-Penetrating AccuFit 360 Mobile Safety Railing System: Provide EDGE Fall Protection LLC's AccuFit 360 Architectural Flat Roof Fall Protection System. Contact: info@edgefallprotection.com; TF/Fax: 844-314-1374. www.edgefallprotection.com. System is a non-penetrating freestanding pedestrian egress barrier system for roofs. Include stanchions, weighted base plates, and accessories in the configuration and locations indicated on the drawings.

1. Roof Edge Protection: Provide freestanding pedestrian egress barrier system on roof, including railings, bases, and hardware by EDGE Fall Protection, LLC; info@edgefallprotection.com; www.edgefallprotection.com.
    1. ACCU-FIT Traditional Mobile Safety Rail System, : ACCU-FIT Designer Mobile Safety Rail System
        1. System shall have top and mid rail in accordance with OSHA Standards – 29 CFR 1910.23 (a)(2).
        2. Structural Load: 200 lb (90.7 kg), minimum, in any direction to all components in accordance with OSHA Regulation 29 CFR 1926.502.
    2. Height: 42 inches (1067 mm), nominal.
    3. Pipe Railings: 1-1/4 inch I.D. schedule 40 pipe by 21 foot length, to be assembled free of sharp edges and snag points. Field trim pipes to fit application on corners or terminations.
        1. Connections; Join pipe railing lengths together with approved splice fittings. Tighten all set screw connections to 29 ft. lbs.
        2. Modular Pipe Fittings to be cast iron fittings manufactured to the requirements of ASTM A 47-77-32510
        3. Stanchions:
            1. Curved Architectural Stanchions 1-1/4 inch I.D. schedule 40 pipe by 42 inches tall in base.

4. Mounting Bases: Freestanding 104 lb (Galvanized) Class 30 gray iron material cast with four receiver posts.
    1. Provide rubber pads on bottom of bases.
5. Receiver Posts: Stanchion shall be pinned into base plate with 3 inch Z-pin
6. Securing Pins: 1010 carbon steel, zinc plated and yellow chromate dipped. Pins shall consist of collared pin and latch that connects to lynch pin.
7. Rail Accessories:
    1. Toe Board Brackets: Provide toe board brackets as required
    2. Finishing Rail: D-shaped railing extension for ladder landings, length of rail section and D-loop as indicated on the Drawings.
    3. Ladder Spanner Brackets: Provide brackets at ladder transition points as required.
8. Roof Accessories:
    1. Roof Pads: Provide TPO Roof Pad under each base to protect roof membrane.
    2. Base Mover: Provide Base Mover, Part #400062 two-wheeled steel cart to transport one base unit.
9. Finish: Steel surfaces
    1. Hot Dip Zinc Galvanized & Factory finished powder coat paint.
        1. Color:
            1. Black



END OF SECTION 077100

SECTION 07720 - ROOF ACCESSORIES

1.GENERAL

1. SUMMARY

A. This Section includes the following:

1. Roof curbs.
2. Equipment supports.
3. Relief vents.
4. Ridge vents.
5. Roof hatches.
6. Roof walkways.
7. Heat-and-smoke vents.

2. SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items.

D. Samples: For each exposed finish.

3. QUALITY ASSURANCE

A. Standards: Comply with the following:

1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

2.PRODUCTS

1. MATERIALS

A. Aluminum:

1. Sheet: ASTM B 209 (ASTM B 209M) for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.
2. Extrusions: ASTM B 221 (ASTM B 221M) alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated.

B. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Security Grilles: 3/4-inch- (19-mm-) diameter, hardened steel bars spaced 6 inches (150 mm) o.c. in one direction and 12 inches (300 mm) o.c. in other. Weld bar intersections and ends of bars to structural frame or primary curb walls. Clean and paint with rust-inhibitive metal primer.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

1. Provide nonremovable fastener heads.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coating.

H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

I. Elastomeric Sealant: Recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25.

J. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2. ROOF CURBS AND EQUIPMENT SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AES Industries, Inc.
2. Colony Custom Curbs.
3. Commodity Products Company, Inc.
4. Conn-Fab Sales, Inc.
5. Curbs Plus, Inc.
6. Custom Curb, Inc.
7. Gieske Custom Metal Fabricators.
8. Goeller Enterprises.
9. LMCurbs.
10. Loren Cook Company.
11. Metallic Products Corporation.
12. Pate Co. (The).
13. Roof Products & Systems Corp.
14. ThyCurb, Inc.
15. Uni-Curb, Inc.
16. Vent Products Co., Inc.

B. General: Units capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Coordinate dimensions with equipment to be supported.

1. Provide preservative-treated wood nailers at tops of units and formed flange at perimeter bottom for mounting to roof.
2. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
3. Fabricate units to minimum height of 8 inches (200 mm), unless otherwise indicated.
4. Where slope of roof deck exceeds 1/4 inch per foot (1:48), fabricate support units with height tapered to match slope to level tops of units.

C. Roof Curbs:

1. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.0747-inch- (1.9-mm-) thick, structural-quality, hot-dip galvanized or aluminum-zinc alloy-coated steel sheet; factory primed and prepared for painting with welded or sealed mechanical corner joints.
2. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.063-inch- (1.6-mm-) thick, sheet aluminum with welded corner joints.
3. Insulation: Manufacturer's standard rigid or semirigid insulation where indicated.
4. Cants: Formed cants and base profile coordinated with roof insulation thickness.

D. Equipment Supports: Capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Coordinate dimensions with equipment to be supported.

1. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.0747-inch- (1.9-mm-) thick, structural-quality, hot-dip galvanized or aluminum-zinc alloy-coated steel sheet; factory primed and prepared for painting with welded or sealed mechanical corner joints.
2. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.063-inch- (1.6-mm-) thick, sheet aluminum with welded corner joints.

3. RELIEF VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aura Ventilation, Inc.
2. Bristolite Skylights.
3. Commodity Products Company, Inc.
4. Dowco Products Group.
5. Dur-Red Products, Inc.
6. Goeller Enterprises.
7. Metallic Products Corporation.
8. Solar Group (The).
9. ThyCurb, Inc.
10. Trimco, Inc.
11. Vent Products Co., Inc.
12. Western Canwell.

B. Low-Profile Gravity Ventilators: Of sizes, style, and profile indicated.

1. Material: Aluminum sheet.

a. Prime-Painted Finish: Manufacturer's standard exterior galvanized steel primer specified in Division 9 Section "Painting."
b. Baked-Enamel Finish: Manufacturer's standard two-coat thermocured system.

1) Color and Gloss: As selected from manufacturer's full range.

c. High-Performance Organic Coating Finish: Fluoropolymer three-coat system with topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with ASCA 96 or AAMA 620 for aluminum.

1) Color and Gloss: As selected from manufacturer's full range.

2. Roof Curb Construction: Curb-mount units designed for installing 1-1/2-inch- (38-mm-) thick wood curbs.

3. Roof Curb Construction: Self-flashing units with integral self-supporting double-wall aluminum curb, enclosing minimum 1-inch- (25-mm-) thick, glass-fiber board insulation (or equivalent), and with minimum 3-inch (75-mm) roof flanges.

4. ROOF HATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis Hatchways, Inc.
2. Bilco Company.
3. Bristolite Skylights.
4. Custom Curb, Inc.
5. Dur-Red Products, Inc.
6. Goeller Enterprises.
7. Hi Pro International, Inc.
8. J. L. Industries, Inc.
9. Metallic Products Corporation.
10. Milcor, Inc.
11. Nystrom Products Co.
12. O'Keeffe's Inc.
13. Precision Stair Corporation.
14. Roof Products & Systems Corp.
15. ThyCurb, Inc.
16. Trimco, Inc.
17. Wasco Products, Inc.

B. General: Frame with minimum 9-inch- (225-mm-) high, integral-curb, double-wall construction with 1-1/2-inch (38- mm) insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1- inch- (25-mm-) thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.

1. Fabricate units to withstand 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loading pressure.

C. Single-Leaf Personnel Hatches:

1. Size: [As indicated] [30 by 36 inches (750 by 900 mm) for ladder access] [30 by 54 inches (750 by 1370 mm) for ship's ladder access] [30 by 102 inches (750 by 2590 mm) for stair access] <Insert size>.

5. ROOF WALKWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. For Flat Roofs: Provide resilient, hard rubber pads under each support unit to isolate supports from and protect roof membrane.
2. For Sloped Roofs: Provide support stands designed for type of roof installed.

B. HATCH-TYPE UNITS: Equip units with unit support, lid, lid gaskets, automatic self-lifting mechanisms, UL-listed fusible links rated at 160 deg F (71 deg C) or other heat- or smoke-sensitive release devices, as indicated, and hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of covers.

1.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Babcock-Davis Hatchways, Inc.
b. Bilco Company.
c. Bristolite Skylights.
d. Custom Curb, Inc.
e. Dur-Red Products, Inc.
f. Goeller Enterprises.
g. Hi Pro International, Inc.
h. Milcor, Inc.
i. Naturalite Skylight Systems.
j. Nystrom Products Co.
k. O'Keeffe's Inc.
l. ThyCurb, Inc.
m. Wasco Products, Inc.

3. When release is actuated, cover will open against 10-lbf/sq. ft. (0.5-kPa) snow or wind load and lock in position.

4. Double-Leaf Lid: Covers with 1-inch (25-mm) integral insulation; material and finish matching framing.

5.

3.EXECUTION

1. INSTALLATION

A. General: Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction to ensure that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details in NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

G. Heat-and-Smoke Vents: Locate, install, and test according to NFPA 204M.

H. Snow Guards: Install according to manufacturer's written recommendations and NRCA's "Steep Roofing Manual." Unless otherwise indicated, locate snow guards at 18 inches (450 mm) o.c. horizontally, and at every other course vertically, beginning 24 inches (600 mm) up from gutter. Stagger snow guard location by 9 inches (225 mm) between courses.

I. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07720

SECTION 08 14 10 FLUSH WOOD DOORS

1.GENERAL

1. SECTION REQUIREMENTS

A. Submittals: Samples for painted flush wood doors.

2.PRODUCTS

A. MANUFACTURERS: Manufacturers:

A. Algoma Hardwoods, Inc.

B. Ampco, Inc.

C. Buell Door Company Inc.

D. Chappell Door Co.

E. Eagle Plywood & Door Manufacturing, Inc.

F. Eggers Industries.

G. Graham; an Assa Abloy Group company.

H. Haley Brothers, Inc.

I. Ideal Architectural Doors & Plywood.

J. Ipik Door Company.

K. Lambton Doors.

L. Marlite.

M. Marshfield Door Systems, Inc.

N. Mohawk Flush Doors, Inc.; a Masonite company.

O. Oshkosh Architectural Door Company.

P. Poncraft Door Company.

Q. Vancouver Door Company.

R. VT Industries Inc.

19. FLUSH WOOD DOORS.

T. Doors for Opaque Finish:

1. Solid-Core Doors: **Custom** grade, **five**-ply, structural composite lumber cores.

a. Faces: **Medium-density overlay or any closed-grain hardwood**.

b. Glass options up to 90 minutes per drawings

c. Warranty: Limited Lifetime

U. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Public toilets, Janitor's closets, Assembly spaces, Exits
3. Standard Duty: Closets (not including janitor's closets)

V. Blocking: Provide blocking or provide structural composite lumber cores instead of particleboard cores for doors with exit devices.

W. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated. Provide the following for mineral-core doors:

1. Composite blocking where required to eliminate through-bolting hardware.

2. LOUVERS AND LIGHT FRAMES

A. Louvers: N/A

B. Light Frames: WOOD BEADS of species compatible with door faces.

1. At fire-rated doors provide beads to match door finish and approved for use in doors of fire-protection rating indicated.

3. FABRICATION AND FINISHING

A. Factory fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

C. Cut and trim openings to comply with referenced standards.

1. Trim light openings with moldings indicated.
2. Factory install glazing in doors indicated to be factory finished.
3. Factory install louvers in prepared openings.

D. Factory finish doors indicated for opaque finish with manufacturer's standard finish complying with WDMA OP-6, catalyzed polyurethane for grade specified for doors.

1. Sheen: Satin.

2. Color: TBD from manufacturer's selection.

3. EXECUTION

4. INSTALLATION

A. Install doors to comply with manufacturer's written instructions and WDMA I.S.1-A, and as indicated.

1. Install fire-rated doors to comply with NFPA 80.

B. Align and fit doors in frames with uniform clearances and bevels. Machine doors for hardware. Seal cut surfaces after fitting and machining.

C. Clearances: As follows unless otherwise indicated:

1. 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
2. 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering.
3. 1/4 inch (6.4 mm) from bottom of door to top of threshold.
4. Comply with NFPA 80 for fire-rated doors.

D. Repair, refinish, or replace factory-finished doors damaged during installation, as directed by Architect.

END OF SECTION 08 14 10

SECTION 08 50 00 - WOOD WINDOWS

1.GENERAL

1. SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and Color Samples.

B. Provide AAMA- or WDMA-certified aluminum clad wood windows with an attached label.

2.PRODUCTS

1. WOOD WINDOWS

2. THERE ARE SEVERAL DIFFERENT TYPES OF WINDOWS BASED ON THE LOCATION IN THE BUILDING ADDITION OR THE EXISTING STRUCTURE:

A. NEW WINDOWS IN THE EXISTING OPENINGS:

a. Provide new, factory painted wood windows with 'Baltimore' Bullnose Sash for new window opening in the existing structure.

b. Basis of Design: Eclipse, EW300 Single Hung Window manufactured by Trimline Windows, Inc, Northampton Township Business & Technology Center, 50 Louise Drive Ivyland, PA 18974, 215-672-5233, or a comparable product of one of the following:
1) Sierra Pacific Windows.
2) Lincoln Windows, Inc.
3) Hurd Windows and Doors, Inc.
4) JELD-WEN, Inc.
5) Kolbe & Kolbe Millwork Co., Inc.
6) Marvin Windows and Doors.
7) Pella Corporation.
8) Weather Shield Mfg., Inc.

B. NEW WINDOWS IN THE NEW STRUCTURE:

a. Provide new composite windows in the new structure.

B. Basis-of-Design Product: Andersen 100 Series Fixed Windows

a. Fibrex® Windows as manufactured by Andersen Windows, Inc., Andersen Service Center, 100 Fourth Ave North, Bayport, MN 55003-1096. Telephone: (800) 299-9029. Performance: LC-PG50, maximum size 50 inches (1270mm) by 72 inches (1829mm). Single or Mulled units. Requires installation screws on each side of mull.

b. Jamb Width: Standard 4-9/16 inches (116mm)

C. GLAZING

1. Provide Low-E 366 Glazing.

D. Window Types: **Indicated on Drawings:**

E. Exterior Color: For Factory Primed and Painted- Color to be selected from Sherwin Williams Colors.

F. Andersen Windows 100 Series to be White Interior and Exterior.

3. WINDOWS

A. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Wood Species: Pine

2. Performance Class: LC.
3. Performance Grade: 40.
4. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.26
5. Solar Heat-Gain Coefficient: NFRC 200 maximum whole-window SHGC of 0.27.
6. Windborne-Debris Resistance: Windows pass enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886.

B. Exterior Trim: Provide wood bullnose brick trim matching material and finish of frame members. Provide Historic exterior sill, and Extension Jambs at all masonry openings.

C. Provide 4" Historic Bottom Rail on window sashes.

D. Provide optional 3/8" foam wrap for air tight installation.

E. Provide concealed block and tackle balance system with locking cam action pivot shoes. Test per AAMA 902-07.

F. Hardware: Eclipse Satin Nickel

G. Equip units with Better View™ high transparency screening in charcoal fiberglass cloth mesh insect screens at operable sashes.

H.

I. Provide 10 year warranty—20 years non-prorated on insulating glass.

3.EXECUTION

1. INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.

B. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

C. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

D. Clean glass surfaces immediately after installing windows. Remove nonpermanent labels from glass surfaces.

END OF SECTION 085000

SECTION 08 71 00 - DOOR HARDWARE

1. GENERAL

A. SUMMARY Section includes door hardware for the following

I. Swinging Doors

2 REFERENCES

American National Standards Institute/Builders Hardware Manufacturers Association (ANSI)

ANSI/BHMA A156.1 Butts & Hinges (2006).
ANSI/BHMA A156.2 Bored & Preassembled Locks & Latches (2011).
ANSI/BHMA A156.3 Exit Devices (2008).
ANSI/BHMA A156.4 Door Controls - Closers (2008).
ANSI/BHMA A156.5 Cylinders and Input Devices for Locks (2010).
ANSI/BHMA A156.6 Architectural Door Trim (2010).
ANSI/BHMA A156.7 Template Hinge Dimensions (2009).
ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders (2010).
ANSI/BHMA A156.10 Power Operated Pedestrian Doors (2011).
ANSI/BHMA A156.12 Interconnected Locks & Latches (2005).
ANSI/BHMA A156.13 Mortise Locks & Latches (2005).
ANSI/BHMA A156.14 Sliding & Folding Door Hardware (2007).
ANSI/BHMA A156.15 Closer Holder Release Devices (2011).
ANSI/BHMA A156.16 Auxiliary Hardware (2008).
ANSI/BHMA A156.17 Self Closing Hinges & Pivots (2010).
ANSI/BHMA A156.18 Materials & Finishes (2006).
ANSI/BHMA A156.19 Power Assist & Low Energy Power Operated Doors (2007).
ANSI/BHMA A156.21 Thresholds (2009).
ANSI/BHMA A156.22 Door Gasketing Systems (2012).
ANSI/BHMA A156.23 Electromagnetic Locks (2010).
ANSI/BHMA A156.24 Delayed Egress Locks (2003).
ANSI/BHMA A156.25 Electrified Locks (2007).
ANSI/BHMA A156.26 Continuous Hinges (2006).
ANSI/BHMA A156.28 Keying Systems (2007).
ANSI/BHMA A156.29 Exit Locks and Alarms (2007).
ANSI/BHMA A156.30 High Security Cylinders (2007).
ANSI/BHMA A156.31 Electric Strikes (2007).
ANSI/BHMA A156.32 Integrated Door Assemblies (2008).
ANSI/BHMA A156.36 Auxiliary Locks (2010).
ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames

ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2006).
ANSI/BHMA A250.13 Testing and Rating of Severe Windstorm Resistant Components Swinging Door Assemblies (2003).

International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2003.
ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2009.
Americans with Disabilities Act Accessibility Guidelines (ADAAG).

Underwriters Laboratories, Inc. (UL):
UL 10C Positive Pressure Fire Test of Door Assemblies.
UL 1784 Air Leakage Test of Door Assemblies.
UL/ULC Listed.

Door and Hardware Institute (DHI):
DHI Publication - Keying Systems and Nomenclature (1989).
DHI Publication - Abbreviations and Symbols.
DHI Publication - Installation Guide for Doors and Hardware.
DHI Publication - Sequence and Format of Hardware Schedule (1996).

NFPA 70 National Electrical Code 2005.
NFPA 70 National Electrical Code 2008.
NFPA 70 National Electrical Code 2011.
NFPA 80 Standard for Fire Doors and Other Opening Protective's 1999.
NFPA 80 Standard for Fire Doors and Other Opening Protective's 2007.
NFPA 80 Standard for Fire Doors and Other Opening Protective's 2010.
NFPA 101 Life Safety Code 2003.
NFPA 101 Life Safety Code 2006.
NFPA 101 Life Safety Code 2012.
NFPA 105 Standard for the Installation of Smoke Door Assemblies 2003.
NFPA 105 Standard for the Installation of Smoke Door Assemblies 2007.
NFPA 105 Standard for the Installation of Smoke Door Assemblies 2010.

Building Codes
IBC International Building Code 2015.
Local Building Code.

3. SECTION REQUIREMENTS.

A. Submittals: Hardware schedule and keying schedule.

B. Shop Drawings: Hardware schedule shall be organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols.

Complete nomenclature of items required for each door opening as indicated

1. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
2. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal. PRODUCTS

C. Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.

D. Closeout Submittals: Submit to Owner in a three ring binder and Flash Drive.
   1. Warranties.
   2. Maintenance and operating manual including list of maintenance tools.
   3. Maintenance service agreement.
   4. Record documents.
   5. Copy of approved hardware schedule.
   6. Copy of approved keying schedule with bitting list.
   7. Door hardware supplier name, phone number and fax number.

E. Electrified door hardware shall be Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.

F. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.
   1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware 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.

G. Door hardware shall conform to ICC/ANSI A117.1. Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

H. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in 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 UL 10C, unless otherwise indicated.

I. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report shall be submitted to Owner and Contractor. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements.

J. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies test-

ed according to UL 1784 and installed in compliance with NFPA 105.

K. Door hardware shall be certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

L. Pre-installation Meeting: Comply with requirements in Division 1 Section "Project Meetings".
   1. Convene meeting seven days before installation. Participants required to attend:
   2. Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant and fire alarm consultant.
   3. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
   4. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
   5. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

M. Within fourteen days of receipt of approved door hardware submittals contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owners instructions.

N. Installer Qualifications: Specialized in performing installation of this Section and shall have five years minimum documented experience.
   1. HARDWARE

A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated. On exit devices provide label indicating "Fire Exit Hardware."

2. WARRANTY

A. General Warranty: Owner may have under 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. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights. Contractor, hardware supplier, and hardware installer shall be responsible for servicing hardware and keying related problems.
   1. Ten years for manual door closers.
   2. Five years for mortise, auxiliary and bored locks.
   3. Five years for exit devices.
   4. Two years for electromechanical door hardware.

C. Products judged defective during warranty period shall be replaced or repaired in accor-

dance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.

A. Hinges:

1. Manufacturers: **Basis of Design: REFER TO DRAWING SCHEDULE**

    a. Baldwin Hardware Corporation.
    b. Bommer Industries, Inc.
    c. Cal-Royal Products, Inc.
    d. Hager Companies.
    e. IVES Hardware; an Ingersoll-Rand company.
    f. Lawrence Hardware Inc.
    g. PBB, Inc.
    h. Stanley Commercial Hardware; Div. of The Stanley Works.

2. Non-removable hinge pins for exterior and public interior exposure.
3. Anti-ligature Hinges for interior bedroom doors.
4. Two hinges for 1-3/8-inch- (35-mm-) thick wood doors.
5. Three hinges for 1-3/4-inch- (45-mm-) thick doors 90 inches (2300 mm) or less in height; four hinges for doors more than 90 inches (2300 mm) in height.

B. Locksets and Latchsets:

1. Manufacturers: **Basis of Design: REFER TO DRAWING SCHEDULE**

    a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    b. Schlage Commercial Lock Division; an Ingersoll-Rand company.
    c. Corbin Russwin
    d. Stanley Commercial Hardware; Div. of The Stanley Works.

2. BHMA A156.2, Series 4000, Grade 1 for bored locks and latches.
3. BHMA A156.3, Grade 1 for exit devices.
4. BHMA A156.5, Grade 1 for auxiliary locks.
5. BHMA A156.12, Series 5000, Grade 1 for interconnected locks and latches.
6. BHMA A156.13, Series 1000, Grade 1 for mortise locks and latches.
7. Lever handles on locksets and latchsets
8. Anti-ligature passage levers for bedroom entrance doors.
9. Provide trim on exit devices matching locksets.

C. Key locks to Owner's new master-key system.

1. Cylinders with **five**-pin tumblers.

2. Provide cylinders for other locking doors that do not require other hardware.
3. Provide construction keying.
4. Provide key control system, including cabinet.

C. ELECTROMAGNETIC HOLDERS

A. Shall be of one manufacturer as listed for continuity of design and consideration of warranty. Manufacturer shall meet requirements for:
   1. ANSI 156.15 Grade 1.
   2. UL/ULC listed.

B. Material and Design: Provide electromagnetic holders where self-closing fire doors and smoke barrier doors are required to be held open. Electromagnetic holders to be fail safe, when electrical current is interrupted, doors release to close automatically. Holding force shall be 25-40 lb (11.25 to 18 Kg).

C. Acceptable Manufacturer:
   1. Hager Companies: 380 Series.

A. Closers:

1. Manufacturers: **Basis of Design: REFER TO DRAWING SCHEDULE** or one of the following:

   a. LCN Closers; an Ingersoll-Rand company.
   b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
   c. Stanley Commercial Hardware

2. Mount concealed closers on top of door and underside of frame of door opening.
3. Provide Adjustable delayed opening feature on closers.

B. Exit Devices:

1. Manufacturers: **Basis of Design: REFER TO DRAWING SCHEDULE** or one of the following:
   a. Von Duprin
   b. Sargent/Corbin Russwin
   c. phi Precision Hardware

4. DOOR GASKETING AND WEATHERSTRIP

A. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.
   1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4 inches (102 mm) beyond width of door.

B. Standards: Manufacturer shall meet requirements for:
1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
2. Shall be BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing. (721).

C. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to authorities having jurisdiction, for smoke control indicated. Provide smoke labeled gasketing on 20 minute rated doors and on smoke rated doors.

D. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

E. Refer to Wood Doors specification for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required. Provide Hager # 720 for single and 720 by 724 for a pair of doors.

5. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame. Manufacturer shall meet requirements for: Auxiliary Hardware: ANSI/BHMA A156.1

6. Hardware Finishes:

1. Refer to schedule on Drawings.

4.EXECUTION

1. INSTALLATION

A. Mount hardware in locations required to comply with governing regulations and according to SDI A250.8 and DHI WDHS.3.

B. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet.

C. Deliver keys to Owner.

2. HARDWARE SCHEDULE

1. **REFER TO DRAWING SCHEDULE**

END OF SECTION 08 71 00

Section 09 20 00 Historic Plaster Repair

Part I General

A. The renovation portion of the Project is an historic structure. All work shall be completed in such a way as to protect existing architectural features from damage and to retain as much historic fabric as possible, with a minimum of loss.

B. The work of this section consists of evaluating the condition and then patching and repairing areas of removed or damaged plaster, the removal of modern plaster patches, repairing cracks larger than hairline, and applying a scratch, float, or setting coat, where required, to restore and preserve wall and ceiling areas to a physically and historically compatible finish.

C. The scope of work includes the following areas: Existing interior meeting rooms on the first and second floors and the two offices rooms in the front of the second floor. The ceiling in the existing stairway is to be replaced with a GWB system as indicated.

1-2 Quality assurance

A. Standards:

1. For materials; as noted.

2. For repair determinations, a Plaster Repair Contractor in consensus with the Architect and Owner's representatives will determine the extent of repair.

B. Materials: as stated or by approval of the Owner's representative

C. Qualifications of Historic Plaster Repair Contractor: Must be experienced in all phases of historic plaster repair, specifically lime based plasters, the preservation and reproduction thereof. The contractor must have six years and/or four projects of similar historical significance. They should have had training at a nationally recognized hands-on training program in historic plaster repair that stresses the stabilization of historic plaster with conservation adhesives.

1-3 Submittals, prior to commencement of work:

A. Submit written repair procedures to Owner's representative.

B. Execute two sample panels of replacement plasters to be used as standards for the patching material.

C. Submit documentation of adhesive reattachment plaster projects.

D. This section may be waived in any or all of its parts by the Owner's representative as warranted.

1-4 Job Conditions

A. Protect and cover all adjacent architectural features and work completed by other trades.

B. Determine what substrates to which plaster materials are to be applied are sound and free from defects affecting proper application of the lime plaster. Report defective surfaces to the CO.

C. Insure that a minimum temperature of 65 degrees F is maintained for an adequate period prior to, during and after application of plaster and that heating and/or ventilation is properly regulated to insure correct curing of the lime plaster.

1-5 Product Handling

Follow manufacturers directions, and store materials where directed on site to prevent damage.

PART II: Materials

2-1 Basecoat Plasters (course stuff), for application on wood lath or masonry

Mix lime putty, 1:3, with sand, for the scratch coat, well haired

Mix lime putty, 1:2.0-2.5, with sand, for the float coat, haired

OR: formulate according to mortar analysis or volumetric test

2-2 Finish coat Plasters or small area, crack repair

Mix lime putty, 1:1, with graded sand, for the finish coat,

OR;

Mix lime putty, 3:1, with gauging plaster

OR;

Mix according to the mortar analysis or volumetric test

2-3 Gauging Plaster

USG Champion Quality Gauging Plaster or equal

2-4 Lime

Lime putty that has emley plasticity greater than 400, 98% or better calcium, and a high surface area of 30m2/gram or better. Lime putty matching these specifications is available from Traditional & Sustainable Building, www.traditionalandsustainable.com at 443-822-0983,

2-5 Sand

Sand shall be well graded, masons, and shall be clean and free of dirt, and organic substances. Or match the existing historic sand as determined by the CO and/or the mortar analysis.

2-6 Fiber for Scratch and Float coats

The allowable fibers are as determined by mortar analysis or as follows in order of priority, hemp, goat hair, cattle hair, hog hair, jute, sisal, or manila. The fiber should be 1″ to 1/2″, in length. It shall be added in the proportion of 1/2 pound of fiber to 2.25 cubic feet of course stuff.

2-7 Water shall be clean, fresh, potable, and free from organic substances.

2-8 Bonding agents will not to be used without specific permission of the CO.

2-9 Adhesive, for the reattachment and stabilization of loose plasters, use Big Wally's Plaster Magic Adhesive and Big Wally's Plaster Magic Conditioner will be used according to, manufacturer's directions

2-10 Metal Lath, not for application on sound exposed wood lath or over sound masonry

Galvanized steel expanded (diamond) mesh lath if needed.

The tie wire shall be 18 ga. galvanized soft annealed wire.

2-11 Fasteners

For wood lath to wood framing, stainless steel, ring shank siding nails.

For metal lath to wood framing, galvanized or stainless steel bugle head deck screws and galvanized metal plaster washers.

PART 3: EXECUTION

3-0 Evaluation of plaster condition

The Historic Plaster Repair Contractor shall conduct an evaluation and in conjunction with the CO formulate a plan for the plaster repair on these surfaces.

3-1 Adhesive reattachment- Big Wally's Plaster Magic Adhesives are to be used according to manufacture's specifications. For contact information please call Big Wally's Adhesives, Inc., 802-254-1330, or e-mail, info@plastermagic.com .

3-2 Preparation; for plaster repair

A. At modern patches, evaluate their soundness and remove if necessary.

B. At exposed wood lath, re-secure to existing framing with stainless steel nails or pre-drill holes for deck screw attachment. Clean out keys and vacuum clean. Attach perimeter of sound plaster with an approved conservation adhesive, (see, 3-1), allow to coalesce as necessary. Rake perimeter of hole, to cut it back, for replacement plaster to tuck in behind the existing plaster.

C. Dampen wood lath until the surface is damp; using Big Wally's Plaster Magic Conditioner.

D. Replace missing wood lath with similar materials. It is not appropriate to mix wood and metal lath.

E. At existing sound plaster bases/ delaminating top coats: Determine, in consultation with the CO, which delaminations are to be saved and which are to be removed. Reattach the ones that are to be saved with the conservation adhesive and remove the others.

F. The cracks are not to be raked out. This cuts the fiber binder that is still bridging the crack. This raking would weaken the plaster stability. If the fibrous binder is rendered by the width of the crack it is permissible to rake out the crack after stabilization with adhesives.

3-3 Application of plaster

A. Large area repair, adhere the perimeter of the opening and fill with two to three layers of the lime/ sand/hair basecoat plaster, no more than 5/16″ per coat, and a finish coat, flush with the surrounding surfaces.

B. Small area repair, two inches or larger, fill with large area material, smaller, fill with crack fill material, flush with the surrounding surfaces.

C. Crack fill rake out crack , (only if fibrous binder is rendered, if crack fiber is intact do not rake out) to approximately 1/2″ depth and fill with non sanded finish coat material, flush with the surrounding surfaces. If crack is not open then topping with a thin layer of ready mix joint compound after stabilization is appropriate.

D. Surface delaminations, remove as necessary, and replace with non-sanded finish coat material, flush with the surrounding surfaces.

E. Skim surface for cosmetic effect with joint compound, either ready mix or setting type.

F. Moldings, remove old repairs, evaluate conditions in conjunction with CO and decide on course of repair. Repair to follow crack repair specifications keeping true to profile.

End Section 09 20 00 Historic Plaster Repair

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

1.GENERAL

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.

2. SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

3. PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

4. ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
3. Laboratory Test Reports for Credit EQ 4: For ceiling systems, documentation indicating that products comply with the testing and product 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."

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

D. Samples for Initial Selection: For components with factory-applied color finishes.

E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.

5. INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

6. CLOSEOUT SUBMITTALS

A. Operational and Maintenance Data: Submit maintenance instructions to Owner for recommended cleaning materials and methods for panels ad trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

7. 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to (3) three percent of quantity installed.
3. Hold-Down Clips: Equal to (3) Three percent of quantity installed.
4. Impact Clips: Equal to (3) Three percent of quantity installed.

8. QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

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. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

9. DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a space where they will be protected against damage from direct sunlight, surface contamination, and other causes.

B. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

2.PRODUCTS

1. PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; 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 the listings of another qualified testing agency.
2. Humidity Resistance: Ensure panels are dimensionally stable at up to 100 percent relative humidity at temperatures ranging from 32 to 104 deg F (0 to 40 deg C) without having to acclimatize tiles.

2. ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product 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."

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Stone Wool (Mineral Wool) Panels: Meeting UL GreenGuard Gold Certification for VOC emissions.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface in accordance with ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

3. ACOUSTICAL PANELS "ACT"

A. Basis-of-Design Product: Subject to compliance with requirements, provide Rockfon "Tropic," As indicated on Drawings.

1. As manufactured by ROCKFON, 4849 S Austin Avenue, Chicago Ilm 60638

B. Performance Criteria: Provide acoustical panels, prefabricated, with white painted textured and/or smooth face, qualified for use in fire rated ceiling assembly, UL labeled, and complying with the following performance criteria as determined by ASTM E 84 and UL 723, and as specified.

1. Flame-Spread Index: Zero.
2. Smoke-Developed: Zero.

C. Color: White.

D. Light Reflectance (LR): Not less than 0.85.

E. Noise Reduction Coefficient (NRC): Not less than 0.90.

F. Ceiling Attenuation Class (CAC): Not less than 25 CAC.

G. Articulation Class (AC): Not less than 190.

H. Edge/Joint Detail: Concealed X.

I. Thickness: 7/8 inch (22 mm).

J. Modular Size: 24 by 48 inches (610 by 1220 mm).

K. Provide acoustical panels that inhibit fungus, mold, mildew, and gram-positive and gram-negative bacteria with a rating of 10, no mold, mildew, or bacterial growth after four weeks exposure when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274 or ASTM G 21.

4. METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled bonded anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
c. Corrosion Protection: Stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/ C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

5. METAL SUSPENSION SYSTEM ACT

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized in accordance with ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Metallic by Rockfon; 1200 (Stab) Seismic 15/16 inch (24 mm) or comparable product by one of the following:

a. Armstrong World Industries, Inc.
b. United States Gypsum Company.

2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Steel or aluminum cold-rolled sheet.
6. Cap Finish: Painted white.

6. METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Rockfon: Infinity or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Fry Reglet Corporation.
3. Gordon, Inc.
4. United States Gypsum Company .

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

7. SPECIALTY PERIMETER MOLDING AND TRIM

A. N/A.

3.EXECUTION

1. EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3. INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, in accordance with manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, and level ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.
    b. Install panels with pattern running in one direction parallel to [long] [short] axis of space.
    c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

G. Specialty Perimeter Molding and Trim:

1. Install after completion of above ceiling work.
2. Install ceiling suspension system as specified and in accordance with ASTM C 636/C 636M.
3. Install perimeter trim in accordance with manufacturer's written instructions, details, and approved Shop Drawings.
4. Perimeter trim to be supported by ceiling-grid suspension system.
5. Attach splice plates and tighten set screws to join perimeter trim.
6. Attach trim to main tees and/or cross tees with grid clips. Field measure and cut tees to length. Attach grid clips to perimeter trim by inserting in grooves, firmly tightening set screws. Contractor to attach grid clips to main tees and cross tees with sheet metal fasteners.
7. Field paint "Rockfon Infinity" for gypsum board sections after gypsum board, taping, joint compound, and sanding is complete.

4. FIELD QUALITY CONTROL

A. Special Inspections: Engage]a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency to select one out of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and test them for 440 lbf (1957 N) of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency shall test anchors not previously tested until 20 consecutive anchors pass, and will then resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

5. CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09 68 00 RESILIENT FLOORING

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Resilient Sheet Flooring

1.0 SUBMITTALS

A. Submit to architect and/or owner two (2) 6.5" x 6.5" (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing. Submit to architect and/or owner ten (10) days before bid, any proposed substitutions for consideration. Submit at least three (3) references of installations using the same flooring technology, as described within this text. Include contact names and telephone numbers.

B. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

C. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.04 F.

PART 2 PRODUCTS 2.01

2.1 MANUFACTURERS

A. Forbo Sphera Energetic

B. Sheet Vinyl

C. Seaming: In accordance with manufacturer’s requirements.

D. Adhesive: In accordance with manufacturer’s requirements.

E. Cleaning: In accordance with manufacturer’s requirements.

F. Colors as indicated on Drawings or to be selected by Architect from Manufacturer’s standard colors.

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Technical specifications

Sphera Energetic meets the requirements of EN-ISO 10581

Binder content	EN-ISO 10581	type 1
Total thickness	EN-ISO 24346	2.0 mm
Surface finish		SMART top
Collection size		52
Commercial use	EN-ISO 10874	34 very heavy
Industrial use	EN-ISO 10874	43 heavy
Roll width	EN-ISO 24341	2 m
Roll length	EN-ISO 24341	≤ 27 m ~ 26 m
Total weight	EN-ISO 23997	2.9 kg/m²
Dimensional stability	EN-ISO 23999	≤ 0.2 %
Residual indentation Typical value	EN-ISO 24343-1	≤ 0.10 mm - 0.03 mm
Abrasion resistance	EN 660-2	group T
Castor chair continuous use	ISO 4918 / EN 425	pass
Light fastness	ISO 105-B02	≥ 7
Flexibility	EN-ISO 24344	Ø 10 mm
Resistance to chemicals	EN-ISO 26987	very good
Slip resistance	DIN 51130	R9
Wetroom application	EN 13553	yes
Bacteria resistance	EN 846	Does not support growth
TVOC after 28 days	ISO 16000-6	≤ 10 µg/m³

Sphera Energetic meets the requirements of EN 14041

EN 14041
CE
0200301-DoP-605

Reaction to fire	EN 13501-1	B_{fl}-s1
Slip resistance	EN 13893	DS - µ ≥ 0.30
Body voltage	EN 1815	≤ 2 kV
Thermal conductivity	EN 12524	0.25 W/m·K

All Forbo Flooring Systems' sales organisations worldwide have a certified Quality Management System in accordance with ISO 9001.
All Forbo Flooring Systems' manufacturing operations have a certified Environmental Management System in accordance with ISO 14001.
The Life Cycle Assessment (LCA) of Forbo Flooring Systems' products is documented in individual Environmental Product Declarations (EPD's) which can be found on all of our websites.

END OF SECTION 09 68 00

SECTION 09 68 13 MODULAR FLOORING

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Textile composite flooring modules as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work in this section only.

1.03 RELATED SECTIONS

Other Division 9 sections for floor finishes related to this section but not the work of this section.

A. Division 3 Concrete - not included work this section.
B. Division 6 Wood and Plastics - not included work this section.
C. Division 7 Thermal and Moisture Protection - not included work this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of flooring installation contractor: All work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floor Covering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in

manufacturer's environmental program including responsible flooring removal, recycling, and installation.

B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive Kinetex modules. The installation standard will be as listed in J+J Flooring Group Kinetex Installation Instructions.

C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

D. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 20 years experience in the manufacture of commercial flooring.

E. Manufacturer to offer a reclamation program for the recycling of existing broadloom carpet, modular carpet tile and textile composite flooring.

F. All warranties must be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J+J Flooring Group's Kinetex installation instruction and maintained according to J+J Flooring Group's Kinetex maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. J+J Flooring Group will provide standard published written performance warranties for the following:

    a. Lifetime product performance. Will not delaminate along seams or lose more than five (5%) percent by weight of fiber during its useful life.
    b. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.
    c. Lifetime Stain Removal
    d. Lifetime Colorfastness (Light and Crocking)

G. Manufacturer to provide field service experts to assist in project start-up as required by the job and will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

H. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by

the manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

a. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass

b. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)

c. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.

d. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.

e. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.

f. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.

g. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30

h. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64

i. Slip Resistance (ASTM 1028-96): Complies with ADA Guidelines for level surface

j. Thermal Insulation (ASTM C 518): R-4

1.05 SUBMITTALS

A. Submit to architect and/or owner ten (10) days prior to bid, two (2) 6.5" x 6.5" (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing. Submit to architect and/or owner ten (10) days before bid, any proposed substitutions for consideration. Submit at least three (3) references of installations using the same flooring technology, as described within this text. Include contact names and telephone numbers.

B. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

C. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.04 F.

1.06 ENVIRONMENTAL/FIELD CONDITIONS

A. Deliver all materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information.

B. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor and/or the manufacturer.

C. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in J+J Flooring Group's Kinetex textile composite flooring installation instructions.

D. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface. It is required that the floor of a renovation project be inspected before the bid date.

E. All materials, including adhesives, are to be delivered to the site of installation at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65°F and below 95°F and measures between 10% and 65% relative humidity (RH). To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) must be in operation. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets). After work is completed, the ambient room temperature should remain at 65°F and relative humidity between 10% and 65% for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.

F. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

1.07 SUBSTITUTIONS

A. All Bid submittals must conform to the specifications in this document.

B. All test results to be in accordance with a certified independent testing laboratory.

PART 2 PRODUCTS 2.01
MANUFACTURERS

A. Acceptable Manufacturer: Kinetex, a brand of J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586. JJFLOORINGGROUP.COM. Please contact CHRIS MASON, (443) 615-1064, chris.mason@jjflooring.com *Any alternate manufacturer and/or product must meet or exceed those requirements specified under all sections of this document in pattern, color, and fiber. Any substitutions must be made in accordance with Section 1.00 of this document.*

2.02 TEXTILE COMPOSITE FLOORING MATERIALS

A. Kinetex flooring modules (tiles):
   a. Product: Refer to Drawings
   b. Color: Refer to Drawings
   c. Backing: Polyester Felt Cushion
   d. Dye Method: Solution Dyed
   e. Wear Layer: Universal Fibers Polyester
   f. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
   g. Pattern Repeat: N/A

h. Soil Release: Yes
i. Standard Size: Refer to Drawings
j. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
k. Testing Specifications - Pill Test: Yes
l. Testing Specifications - Flooring Radiant Panel: Class 1
m. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
n. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
o. Recycled content: Minimum of 55% recycled content
p. NSF/ANSI 140 Platinum Certified
q. Closed-loop recyclable

2.03 ADHESIVES

A. Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.
B. Kinetex PreFix®, a quick installation for all Kinetex textile composite flooring products. The release liner easily peels away to reveal a series of pre-applied adhesive strips that securely anchor the Kinetex module in place, (PreFix Primer is required).

2.04 ACCESSORIES

A. Kinetex requires protective transition 3/16-inch to other floor covering thickness. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.
B. Provide aluminum edge with lip to protect Kinetex edge.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive installation of modules.
C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by J+J Flooring Group.
E. Verify that required floor-mounted utilities are in correct location.
F. J+J Flooring Group requires that Kinetex textile composite flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call J+J Flooring Group's Customer Relations Department at 800.241.4586.

3.02 PREPARATION

A. Starting installation constitutes acceptance of sub-floor conditions.
B. SURFACE PREPARATION- Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Kinetex Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.
C. LATEX ADHESIVES - Old latex adhesives must be mechanically scraped down to a bare residue. Latex adhesive residues must be smooth and level with all holes and cracks filled with a Portland cement-based patch reinforced with polymers, or encapsulated with APAC ENCapSeal. *Note: Failure to remove or seal, old latex adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.*
D. CUT BACK ADHESIVES - Must be wet mechanically scraped to a minimum residue and encapsulated with APAC ENCapSeal. *Note: Failure to remove or seal old cut back adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.*

E. CONCRETE MOISTURE TESTING and pH TESTING - Substrate surfaces must be tested for moisture emission. It is the responsibility of the owner or owner's representative to perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 95% RH when using Kinetex Adhesive and up 99% RH when using Kinetex PreFix. Alkalinity tests should also be performed per ASTM F 710. The maximum acceptable pH is 10.0 when using Kinetex Adhesive and 11.0 when using Kinetex PreFix. *Note: pH readings of 9.0 - 11.00, Commercialon Premium Sealer is required.* SUBFLOORS

F. New Concrete - New concrete must be fully cured and free of moisture (see ASTM F 710). New concrete requires a curing period of approximately 90 days.

G. Old Concrete - Old concrete must be checked for moisture. Dry, dusty, porous floors must be primed or encapsulated with APAC ENCapSeal. *Note: Primers will not correct a moisture problem.*

H. Wood - Wood floors must be APA flooring grade smooth and level, or CanPly Select Grade. If the floor is uneven, an approved underlayment will be required.

I. Terrazzo / Marble - Level all grout lines with Portland cement-based patch reinforced with polymers. Glossy surfaces must be sanded for proper adhesive bond. Waxes and similar finishes must be removed.

J. Other Hard Surfaces (VCT/VAT) - Tiles must be well secured to the floor or removed. Broken, damaged or loose tiles must be replaced. Waxes and similar finishes must be removed from VCT before applying adhesive. Existing sheet vinyl is not a suitable substrate for modular installation and must be removed.

K. Carpet - Remove old carpet and carpet adhesives by scraping or other mechanical means. Any remaining adhesive residues may be covered with a Portland based patching compound or encapsulated with TriSeal Sealer.

3.03 INSTALLATION OF TEXTILE COMPOSITE FLOORING

A. Install flooring in strict accordance with the finish drawings and J+J Flooring Group's Kinetex installation instructions.

B. ADHESIVE SYSTEM - Kinetex requires use of Kinetex Adhesive or PreFix pre-applied adhesive for all Kinetex flooring modules.

1. Full Spread Kinetex Adhesive: The spread rate for Kinetex Adhesive is approximately 1080 square feet per four gallon pail and can be spread using a 1/16" x 1/32" x 1/32" U-notched trowel or applied using a 3/8" foam or nap roller. Allow to dry until transparent or adhesive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried. *Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. J+J Flooring Group will not be responsible for the adhesive bond where other adhesives have been used.*
2. PreFix Pre-Applied Adhesive
3. PreFix Primer Application (REQUIRED) *Note: Read all installation instructions thoroughly.*
    a. Pour the diluted primer onto the substrate and roll on using 3/8" nap or foam roller. Do not puddle. Additional coats may be required upon visual inspection over extremely porous concrete.
    b. Allow the material to dry to the touch. Lower substrate temperatures and/ or higher humid conditions could extend the drying time
4. Installing PreFix Kinetex Modules After the PreFix primer has dried, begin the installation at the intersection of the central module anchor lines. Peel off the release film and save it to be recycled. Complete the installation one quarter area at a time laying the modules firmly and accurately along the anchor lines. *Follow approved installation method(s) for each specific product.*

C. MODULE PLACEMENT - Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/ form the module into place where the new module meets the previously installed module. See specific product specifications for approved installation method(s).

Note: To reposition a Kinetex module during installation, remove it by gently lifting all four sides of the module with a spatula or putty knife, rotating around each side of the module doing a little at a time. The very center of the module should be the last part of the module touching the floor upon removal. Do not stretch a module while it is in the adhesive in order to align next to an adjoin modular. An attempt to stretch will likely result in the module pulling back to its original position. NEVER ATTEMPT TO REMOVE A MODULE ALL AT ONCE BY PULLING ONE OR ONLY TWO SIDES OF THE MODULAR. DOING SO MAY LEAD TO DISTORTING THE MODULE.

D. PALLET AND BUNDLE SEQUENCING - It is very important to install Kinetex modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to J+J Flooring Group's Kinetex Installation Instructions.) E. STAIRS - Use single or double undercut stair nosing and cut modules. Then, using full spread Kinetex Adhesive, install modules on steps and risers, inserting the stair nosing edge and the top of the riser edge of each module into the vinyl undercut.

E. COMPLETING INSTALLATION - To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. It is also required that sheets of plywood or hardboard be laid over the new modular surface when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer's specifications.

3.05 CLEANING AND PROTECTION

A. Use a moist cloth when wet; if dry, use a solvent based product applied to a towel then worked onto the Kinetex module for removal of contaminants such as adhesive, paint, oil and grease. Follow J+J Flooring Group's maintenance guidelines.
B. Clean and vacuum surfaces.

END OF SECTION 09 68 13

SECTION 09912 - PAINTING

1.GENERAL

1. SUMMARY

A. This Section includes surface preparation and field painting of exposed interior items and surfaces.

2. GENERAL DESCRIPTION

A. The design of this project involves considerations for the Baltimore City Green Building Code and the IgCC 2012 Particular attention is required with regard to heating, ventilating, and air conditioning (HVAC) equipment selection and accessories and project commissioning/ commissioning procedures. Also, coordination with other project disciplines with regards to materials and procedures is required.

B. This project must conform to the IgCC 2012 Green Building Code. All contractors must become familiar with the requirements of the IgCC 2012 and specifically the requirements for handling of materials, waste, and air quality.

C. All contractors are responsible for reviewing all specification sections associated with this project for detailed descriptions of installation procedures and documentation requirements.

D. All contractors are responsible for familiarizing themselves with the IgCC ScoreCard.

E. Recycled Content Material (RCM)

1. Materials shall be selected to contain the highest possible percentage of post-consumer and/ or post-industrial recycled content.

2. Contractor shall submit cut sheets, manufacturer's literature, or other submittal information highlighting the percentage of post-consumer and/or post-industrial recycled content.

3. The Contractor shall submit cost information for the materials cost ONLY for each recycled content item installed in the project.

F. Rapidly renewable Material (RRM)

1. For rapidly renewable building materials specified, Contractor shall provide written documentation from the manufacturer declaring the RRM contained in the final building material (including the percentage of RRM used in a specified product).

2. Contractor shall provide specification, manufacturer's information, and other submittal information highlighting the RRM quantities.

3. Contractor shall provide a cost of the material ONLY for each RRM installed in the project.

G. Low Emitting Sealants and Adhesives

1. All sealants used on the project must meet or exceed Bay Area Quality Management District Reg. 8, Rule 51. This guideline limits VOC content in sealants.

2. All adhesives used on the project must be less than the VOC limits of the South Coast Quality Management District Rule #1168.

3. Contractor shall provide cut sheets and MSDS sheets for each adhesive used highlighting the VOC content.

H. Paints

1. Only interior paints and coatings are included in the LEED criteria. Paints must meet of exceed the VOC and chemical component of Green Seal Requirements.

2. Contractor shall provide cut sheets and MSDS sheets for each paint used on the project, highlighting VOC content.

3. SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each type of finish-coat material indicated.

4. QUALITY ASSURANCE

A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5.

1. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m).
2. Small Areas and Items: Architect will designate items or areas required.
3. Final approval of colors will be from benchmark samples.

5. PROJECT CONDITIONS

A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

6. EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: 3 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

2.PRODUCTS

1. MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

1. Benjamin Moore & Co. (Benjamin Moore).
2. Coronado Paint Company (Coronado).
3. ICI Paint Stores, Inc. (Dulux Paint).
4. Kelly-Moore Paint Co. (Kelly-Moore).
5. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
6. PPG Industries, Inc. (Pittsburgh Paints).
7. Sherwin-Williams Co. (Sherwin-Williams).

2. PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: As selected from manufacturer's full range.

3. PREPARATORY COATS

A. Concrete Unit Masonry Block Filler: High-performance latex block filler of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

B. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.
2. Zinc-Coated Metal Substrates: Galvanized metal primer.
3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

C. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
2. Zinc-Coated Metal Substrates: Galvanized metal primer.
3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

4. INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint:

1. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275.
2. Coronado; 28 Line Super Kote 5000 Latex Flat Paint.
3. Dulux Paint; 1200-XXXX Dulux Professional Velvet Matte Interior Flat Latex Wall & Trim Finish.
4. Kelly-Moore; 450 Pro-Wall Interior Flat Latex Wall Paint.
5. M. A. B. Paint; Fresh Kote Latex Flat 402 Line.
6. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint.
7. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series.

B. Interior Low-Luster Acrylic Enamel:

1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274.
2. Coronado; 30-Line Super Kote 5000 Latex Eggshell Enamel.
3. Dulux Paint; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel.
4. Kelly-Moore; 1610 Sat-N-Sheen Interior Latex Low Sheen Wall and Trim Finish.
5. Kelly-Moore; 1686 Dura-Poxy Eggshell Acrylic Enamel.
6. M. A. B. Paint; Fresh Kote Latex Satin Eggshell Enamel 405 Line.
7. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel.
8. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series.

C. Interior Semigloss Acrylic Enamel:

1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276.
2. Coronado; 32-Line Super Kote 5000 Latex Semi-Gloss Enamel.
3. Dulux Paint; 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel.
4. Kelly-Moore; 1649 Acrylic-Latex Semi-Gloss Enamel.
5. Kelly-Moore; 1685 Dura-Poxy Semi-Gloss Acrylic Enamel.
6. M. A. B. Paint; Fresh Kote Latex Semi-Gloss 410 Line.
7. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex.
8. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series.

D. Interior Full-Gloss Acrylic Enamel:

1. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel No. M28.
2. Coronado; 414 Line Super Kote 5000 Acrylic High Gloss Enamel.
3. Dulux Paint; 3028-XXXX Dulux Interior/Exterior Acrylic Gloss Finish.
4. Kelly-Moore; 1680 Dura-Poxy Gloss Acrylic Enamel.
5. M. A. B. Paint; Rich Lux Architectural High Gloss Latex Enamel 022-127 Line.
6. Pittsburgh Paints; 6-8534 SpeedHide Interior Latex 100 Percent Acrylic Gloss Enamels.
7. Pittsburgh Paints; 90-374 Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamel.
8. Sherwin-Williams; ProMar 200 Interior Latex Gloss Enamel B21W201.

5. INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler:

1. Benjamin Moore; Benwood Paste Wood Filler No. 238.
2. Coronado; none required.
3. Dulux Paint; none required.
4. Kelly-Moore; none required.
5. M. A. B. Paint; Paste Wood Filler.
6. Pittsburgh Paints; none required.
7. Sherwin-Williams; Sher-Wood Fast-Dry Filler.
8. Sherwin-Williams; none recommended.

B. Interior Wood Stain: Alkyd based.

1. Benjamin Moore; Benwood Penetrating Stain No. 234.
2. Coronado; 3601-Line Quick-Seal Alkyd Stain.
3. Dulux Paint; 1700-XXX WoodPride Interior Solventborne Wood Finishing Stain.
4. Kelly-Moore; McCloskey Stain.
5. M. A. B. Paint; Wood Stain 062 Line.

6. Pittsburgh Paints; 77-560 Rez Interior Semi-Transparent Oil Stain.
7. Sherwin-Williams; Wood Classics Interior Oil Stain A-48 Series.

C. Clear Sanding Sealer: Fast-drying alkyd based.

1. Benjamin Moore; Moore's Interior Wood Finishes Quick-Dry Sanding Sealer No. 413.
2. Coronado; 81-10 Dual Seal.
3. Dulux Paint; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
4. Kelly-Moore; 2164 E Z Sand Alkyd Q. D. Sealer.
5. M. A. B. Paint; Minit Dri Sanding Sealer 037-005 Line.
6. Pittsburgh Paints; 6-10 SpeedHide Quick-Drying Interior Sanding Wood Sealer and Finish.
7. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43.

D. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish:

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.
2. Coronado; 67-100 Polyurethane Liquid Plastic Satin Varnish.
3. Dulux Paint; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.
4. Kelly-Moore; 2050 Kel--Aqua Stain Base.
5. M. A. B. Paint; Rich Lux Water Based Satin Polyurethane.
6. Pittsburgh Paints; 77-7 Rez Varnish, Interior Satin Oil Clear.
7. Sherwin-Williams; Wood Classics Fast Dry Oil Varnish, Satin A66-300 Series.

E. Interior Waterborne Clear Satin Varnish: Acrylic-based polyurethane.

1. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
2. Coronado; 70-10 Aqua-Plastic Urethane Clear Satin.
3. Dulux Paint; 1802-0000 WoodPride Interior Waterborne Aquacrylic Satin Varnish.
4. Kelly-Moore; 2097 Kel-Thane II Clear Acrylic Urethane--Satin.
5. M. A. B. Paint; Rich Lux Water Based Satin Polyurethane 088-900s.
6. Pittsburgh Paints; 77-49 Rez Satin Acrylic Clear Polyurethane.
7. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.

F. Interior Waterborne Clear Gloss Varnish: Acrylic-based polyurethane.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes High Gloss No. 428.
2. Coronado; 70-10 Aqua-Plastic Urethane Clear Gloss.
3. Dulux Paint; 1808-0000 WoodPride Interior Waterborne Aquacrylic Gloss Varnish.
4. Kelly-Moore; 2096 Kel-Thane II Clear Acrylic Urethane--Gloss.
5. M. A. B. Paint; Rich Lux Water Based Gloss Polyurethane 088-899 Line.
6. Pittsburgh Paints; 77-45 Rez Full-Gloss Acrylic Clear Polyurethane.
7. Sherwin-Williams; Wood Classics Waterborne Polyurethane Gloss, A68 Series.

G. Paste Wax: As recommended by manufacturer.

3.EXECUTION

1. APPLICATION

A. Comply with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    c. If transparent finish is required, backprime with spar varnish.
    d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
    e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. Material Preparation:

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

G. Sand lightly between each succeeding enamel or varnish coat.

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Omit primer over metal surfaces that have been shop primed and touchup painted.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

M. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

O. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

2. CLEANING AND PROTECTING

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3. EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Exterior concrete and masonry primer.
b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

B. Concrete Unit Masonry:

1. Acrylic Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Exterior full-gloss acrylic enamel for concrete, masonry, and wood.

4. INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry):

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior concrete and masonry primer.
b. Finish Coats: Interior low-luster acrylic enamel.

2. Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior concrete and masonry primer.
b. Finish Coats: Interior semigloss alkyd enamel.

B. Concrete Unit Masonry:

1. Acrylic Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Interior low-luster acrylic enamel.

2. Alkyd-Enamel Finish: Two finish coats over a filled surface.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coat: Interior semigloss alkyd enamel.

C. Mineral-Fiber-Reinforced Cement Panels:

1. Flat Acrylic Finish: Two finish coats.

a. Finish Coats: Interior flat acrylic paint.

D. Gypsum Board:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior low-luster acrylic enamel.

2. Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior semigloss alkyd enamel.

E. Ferrous Metal:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior low-luster acrylic enamel.

2. Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss alkyd enamel.

F. Zinc-Coated Metal:

1. Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior low-luster acrylic enamel

2. Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior semigloss alkyd enamel

G. All-Service Jacket over Insulation:

1. Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

a. Finish Coats: Interior flat latex-emulsion size.

5. INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stain-Varnish Finish: Two finish coats of varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.

1. Filler Coat: Open-grain wood filler.
2. Stain Coat: Interior wood stain.
3. Sealer Coat: Clear sanding sealer.
4. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

B. Natural-Varnish Finish: Two finish coats of varnish over a sealer coat and a filler coat.

1. Filler Coat: Open-grain wood filler.
2. Sealer Coat: Clear sanding sealer.
3. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

C. Wax-Polished Finish: Three finish coats of paste wax over a sealer coat and alkyd-based interior wood stain.

1. Stain Coat: Interior wood stain.
2. Sealer Coat: Clear sanding sealer.
3. Finish Coats: Paste wax.

END OF SECTION 09912

SECTION 10 22 26 OPERABLE PARTITIONS

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. This Section includes the following:

1. Electrically operated, continuously hinged partitions.

B. Related Sections include the following:

1. Division 03 Sections for concrete tolerances required.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions*.

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.4 REFERENCE STANDARDS

A. ASTM International

1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
3. ASTM C1036 - Standard Specification for Flat Glass.
4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
5. ASTM E84 - Surface Burning Characteristics of Building Materials.
6. ASTM E413 - Classification for Rating Sound Insulation

B. Health Product Declaration Collaborative

1. Health Product Declaration Open Standard v2.1

C. International Standards Organization

1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.

5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards

1. ADA – Americans with Disabilities Act.
2. UL 508A – Standard for Industrial Control Panels
3. NFPA 70 – National Electrical Code
4. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
5. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
6. NEMA LD3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.

F. Create spaces that are healthy for occupants.

1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.

1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

H. Buy American: Operable partition to be manufactured in the United States in compliance with applicable U.S. Federal Trade Commission (FTC) and U.S. Customs Service and Border Protections regulations and be labeled "Made in America".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Warranty period: Two (2) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

A. Manufacturers: Subject to compliance with requirements, provide product by the following:
1. Modernfold, Inc.
B. Panels to be manufactured in the U.S.A.
C. Products: Subject to compliance with the requirements, provide the following product:
1. Acousti-Seal Premier – Electric Partition (933E) electrically operated continuously hinged operable partition.

2.2 OPERATION

A. Acousti-Seal Premier – Electric Partition (933E): Series of continuously hinged flat panels, electrically operated, top supported with operable floor seals.
B. Final Closure:
1. Side Seal with pocket door interface Acoustic-Seal® Legacy Electric Remote Stack
C. Partition shall be operated by:
1. Two push button control stations wired in series and located on opposite sides and opposite ends of the partition. Control stations shall be activated by key switch at stack end of partition.
2. Modernfold Presto ® Automation Package with Touch Screen Operator Control Station by Modernfold, Inc.
3. Motor unit shall be reversible, continuous duty, and class A insulated. Motor unit shall have NEMA MG 1 service factor, high starting torque, thermal overload protection, and open/drip proof enclosure. Motor assembly shall have wiring compliant with NFPA 70, 24-volt controls, compliant with UL 508A, and speed of 28 feet/minute. The drive unit motor shall be equipped with outboard limit switches to prevent over-extension. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt, or other friction type drives will not be accepted.
D. Electric motor shall be (select one):
1. 120-volt, 1-phase, 1 HP, 14.0 FLA

2.3 PANEL CONSTRUCTION

A. Nominal 3-inch (76 mm) thick panels in manufacturer's standard 48-inch (1220 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
B. Panel Skin Options:
1. 1/2-inch (13 mm) NAUF medium density fiberboard, single material or composite layers continuously bonded to panel frame. Acoustical ratings of panels with this construction (select one):
a. 50 STC
C. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
1. Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.
E. Panel Weights:
1. 50 STC - 8 lbs./square foot

2.4 PANEL FINISHES

A. Panel Face finish shall be:
1. Reinforced heavy-duty vinyl with woven backing weighing not less than 30 ounces (850 g) per lineal yard.

2. Full height steel markerboard work surface.

B. Panel Trim: Exposed panel trim of one consistent color from manufacturer's standard offering, Owner to select one from the following:
1. Dark Bronze
2. Smoke Gray
3. Natural Choice

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed astragals, with reversible tongue and groove configuration in each panel edge, for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal Bottom Seals (select one):

1. A2 - Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.6 SUSPENSION SYSTEM (select one)

A. #14 Suspension System

1. Suspension Tracks: Minimum 7-gage, 0.18-inch (5 mm) roll-formed steel. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 1/2-inch (13 mm) diameter threaded rods. Brackets must support the load bearing surface of the track.

a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.

2. Carriers: All-steel trolleys with steel-tired ball bearing wheels.

3. Warranty period: Ten (10) years.

2.7 OPTIONS

A. Single Pass Door:

1. Matching pass door same thickness and appearance as panels. ADA compliant pass door to be trimless and equipped with friction latch and flush pulls for panic operation. No threshold will be permitted.

B. Hardware:

1. Lever handles both sides of door
2. Automatic door closer.
3. Provide Door viewer.
4. Self-Illuminated exit signs:
    a. Chemical exit sign – recess mount

C. Work Surfaces:

1. N/A.

D. "Presto" Safety Components:

1. Presto Safety Nose (wireless) – High sensitivity pressure leading edge requiring no more than 2.2 lb. of pressure to stop partition movement in case of obstruction. Lead sensors requiring hard wiring through partition system or requiring more than 2.2 lb. of pressure for activation are not acceptable.

Sensing edge to be housed in fluid resistant housing and set in snap in channel for easy maintenance and be provided with 4-lead fail-safe wiring.

2. Presto Safety Mats – Located at panel storage area. Personnel sensing switch mat shall activate with the presence of a minimum 22 lb. obstruction in the stack area and prevent panels from stacking until the personnel/obstruction is removed. Mats shall be provided with 4-lead fail-safe wiring.

3. Presto Vision (PIR/Microwave Detector) – Wall or ceiling mounted motion sensors covering the travel area of the automated partition shall automatically stop the movement of the panels in the presence of unauthorized movement or obstruction. Detector can detect motion in an area up to 300 ft. (91M) long by 7.5 ft. (2.3M) wide and 10 ft. (3M) high and be equipped with anti-masking protection.

E. Available Accessories/Options:

1. Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels. Equipped with electric interlock system.
2. Finished end caps.
3. Intersecting partition interface.
4. Resilient Padding – 1/2-inch (13mm) resilient material covered with heavy-duty vinyl.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

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SECTION 10520 - FIRE-PROTECTION SPECIALTIES

1. GENERAL

1. SUMMARY

A. This Section includes portable fire extinguishers and fire-protection cabinets.

B. See Division 7 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.

C. See Division 9 Section "Painting" for field-painting fire-protection cabinets.

D. See Division 11 Section "Food Service Equipment" for fire extinguishing systems provided as part of exhaust hoods.

E. Division 15 Section "Standpipe and Hose Systems" for fire hoses in cabinets.

2. SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.
3. Show location of knockouts for hose valves.

B. Samples: For each exposed cabinet finish.

3. QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

4. COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

2. PRODUCTS

1. MATERIALS

A. Stainless-Steel Sheet: ASTM A 666/A 666M, Type 302 or Type 304 alloy.

2. PORTABLE FIRE EXTINGUISHERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amerex Corporation.
2. Ansul Incorporated.
3. Badger; Div. of Figgie Fire Protection Systems.
4. Buckeye Fire Equipment Company.
5. Fire-End & Croker Corporation.
6. General Fire Extinguisher Corporation.
7. J. L. Industries, Inc.
8. Kidde, Walter The Fire Extinguisher Co.
9. Larsen's Manufacturing Company.
10. Modern Metal Products; Div. of Technico.
11. Moon/American, Inc.
12. Pem All; Div. of Pem Systems, Inc.
13. Potter-Roemer; Div. of Smith Industries, Inc.
14. Samson Products, Inc.
15. Watrous; Div. of American Specialties, Inc.

B. General: Provide fire extinguishers for each cabinet and other locations indicated.

1. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher indicated and with plated or baked-enamel finish.

a. Provide brackets for extinguishers located in cabinets.

2. Identification: Lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as directed by Architect.

a. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

C. Wet Chemical Extinguisher Model Number: WC SeriesIn Kitchen

D. Multipurpose Dry-Chemical Type:Larsen MP6

3. FIRE-PROTECTION CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Filtrine Manufacturing Company.
2. Fire-End & Croker Corporation.
3. General Accessory Manufacturing Co.
4. J. L. Industries, Inc.
5. Larsen's Manufacturing Company.
6. Modern Metal Products; Div. of Technico.
7. Moon/American, Inc.
8. Potter-Roemer; Div. of Smith Industries, Inc.
9. Samson Products, Inc.
10. Thomas Enterprises.
11. Watrous; Div. of American Specialties, Inc.

B. Fire Protection Cabinet

1. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

a. Fire-Rated Cabinets: Listed and labeled to meet requirements in ASTM E 814 for fire-resistance rating of wall where it is installed.

1) Construct fire-rated cabinets with double walls fabricated from 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.

b. Cabinet Metal: Stainless-steel sheet.

2. Cabinet Type: Suitable for fire extinguisher.
3. Cabinet Mounting: Semi-Recessed.
4. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

a. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.

1) Provide recessed flange, of same material as box, attached to box to act as plaster stop.

5. Cabinet Trim Material: Manufacturer's standard same metal and finish as door.
6. Door Material: Manufacturer's standard stainless-steel sheet.
7. Door Glazing: Manufacturer's standard, as follows:

a. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, Class 1 clear].

b. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm, single strength.

8. Door Style: Manufacturer's standard design fully glazed panel with frame
9. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

a. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

b. Provide inside latch and lock for break-glass panels.

10. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg rees.

a. Break-Glass Strike: Provide manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.

b. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.

c. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

d. Alarm: Provide manufacturer's standard alarm, which actuates when cabinet door is opened and is powered by [batteries] [low voltage, complete with transformer].

11. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

1) Application Process: Silk-screened.
2) Lettering Color: Red.
3) Orientation: Vertical.

4. FINISHES

A. Stainless-Steel Surface Preparation: Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Stainless-Steel Finish: Satin, directional polish, No. 6.

1.

3.EXECUTION

1. INSTALLATION

A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

C. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

D. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure and cabinets, square and plumb.
3. Fasten cabinets to structure, square and plumb.

E. Fire-Rated Hose or Valve Cabinets: Install cabinet with not more than 1/16-inch (1.5-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.

1. Seal through-penetrations with firestopping sealant specified in Division 7 Section "Through-Penetration Firestop Systems."

F. Adjust cabinet doors that do not swing or operate freely.

G. Refinish or replace cabinets and doors damaged during installation.

END OF SECTION 10520

SECTION 21 05 00 - BASIC FIRE SUPPRESSION MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Requirements of this Section are applicable to work in Division 21.

B. Contract Documents

1. Unless otherwise modified, drawings and general provisions of the Contract, including provisions of Division 01 govern work under Division 21.
2. Contract drawings for fire suppression work are diagrammatic, intended to convey scope and general arrangement.
3. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.
4. Correct faulty work due to resolving discrepancies without proper approval.
5. Specifications establish quality of materials, equipment, workmanship and methods of construction.
6. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

C. Scope

1. The work in Division 21 includes furnishing and installing the fire suppression work complete and ready for satisfactory service.
2. Requirements specified govern work in all sections of Division 21.
3. Some of the work described in this Section is also applicable to the scope of Division 28.

1.2 RELATED DIVISIONS

A. Division 01 - General Requirements

B. Division 09 – Finishes

C. Division 28 – Fire Alarm

1.3 PERMITS

A. Obtain and pay for required permits.

1.4 ACTION SUBMITTALS

A. Material and Equipment List:

1. Submit the following for Engineer's review within 30 days of Notice to Proceed. Failure to submit list or name manufacturers acceptable to Engineer within time limit will result in Engineer selecting a list of manufacturers, and selection shall be binding upon Contractor.

    a. A list of subcontractors' names for the proposed work.
    b. A list of manufacturers' names for items proposed for the work.

B. Shop Drawings and Descriptive Data

1. Submit six copies or more electronic copies, in accordance with Division 01, of manufacturer's shop drawings and descriptive data.
2. Establish that the physical and functional character of each item including, size, type and required service access is suited for its intended location and use.
3. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.
4. Call attention, in writing, to deviations from contract requirements.
5. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the Engineer and the shop drawing has been marked to indicate "No Exception Noted" or "Make Corrections Noted."
6. Specifically identify pertinent project data on the shop drawings.
7. Include Operation and Maintenance Data.
8. Use only final or corrected drawings and data for construction.
9. The Engineer's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

C. Manufacturer's technical product data, installation instructions and description of accessories for each type to be used and system designation:

1. Certificate of completion of cleaning of water systems.
2. Paint primer and finish coat.
3. Layout drawings for equipment supports.
4. Pipe penetration seals.
5. Charts for shutoff valve locations.
6. Operating and maintenance manuals.
7. Statement of field instruction completion.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manual

1. Furnish manual bound and indexed containing the following:

a. Brief description of each system and components.
b. Starting and stopping procedures.
c. Special operating instructions.
d. Routine maintenance procedures.
e. Schedule for periodic servicing and lubrication.
f. Manufacturers' printed operating and maintenance instructions, parts lists, illustrations and diagrams.
g. Manufacturers' Data Report Form U-1 certifying code compliance for equipment specified to be constructed in accordance with ASME Code for Unfired Pressure Vessels.
h. One final or corrected reviewed copy of each shop drawing and Contractor's drawings.
i. One copy of each wiring and piping diagram.
j. One reviewed copy of certified test reports.
k. Product warranty information.

B. Submit to Engineer for review at least 30 days prior to date it is expected system will be turned over to the Owner.

C. After review by Engineer, submit three copies to Owner and one to Engineer of Record.

1.7 CONTRACTOR'S INSTALLATION DRAWINGS

A. Refer to "SUPPLEMENTARY CONDITIONS" for requirements.

B. These drawings shall not be construed as shop drawings that require review and action by the Architect or Engineer.

C. Work installed before coordinating with other trades or as to cause any interference with work of other trades must be changed by the Contractor, at the Contractor’s expense, to correct the conditions.

D. Drawings must show existing services where clearances for access are to be maintained.

E. Relocate existing work or modify location of new work as required to maintain required access and code clearances.

1.8 QUALITY ASSURANCE

A. Regulations: Comply with regulations of NFPA, State of Maryland, City of Baltimore and municipal building ordinances, and other applicable codes and regulations.

B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

C. Material and Equipment Requirements

1. Use products of one manufacturer where two or more items of same kind of equipment are required.
2. Materials and equipment must have a record of one-year successful field use.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which, the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.

D. Workmanship

1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate work and cooperate with other trades to facilitate execution of work.

E. Coordination with Other Trades

1. Give full cooperation and coordination with other trades and furnish necessary information to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
2. Furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordinating adjacent work.

F. The use of asbestos or asbestos-containing materials on this project is prohibited. The Contractor shall be rigorous in assuring that all materials, equipment, systems, and components do not contain asbestos. Any deviations from this exclusion must be remedied at the Contractor’s expense without regard to prior submittal approvals.

G. Access: Specifically consider all materials and equipment installations and coordinate with the work of all trades to ensure easy and unobstructed accessibility of all systems for operations, maintenance, repairs, and replacement. Installation of all specified materials and equipment including but not limited to, equipment, supports, pipe, electrical conduit and controls must be performed in a manner that will allow complete unobstructed access to all panels, access doors, filter racks, control boxes, controls actuators, sensors, valves, and all other items requiring access for operations or maintenance. All items such as controls, actuators and valves which require servicing or manual operations for system use shall be located such as to be accessible without standing on other equipment, whenever it is possible or practical. Any installation of new equipment or materials which causes problems related to access of new or existing equipment will be disapproved by the Engineer and re-accomplished by the Contractor.

H. Wood Truss Construction: This project includes wood truss construction for floor-ceiling assemblies and roof-ceiling assemblies. Coordinate the installation of all equipment and piping within the truss space and with the actual construction of the trusses and final installed locations of trusses. Provide offsets as required to coordinate with trusses and other trades. Provide listed access panels for each device that requires access.

I. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

J. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.10 PROJECT CONDITIONS

A. References

1. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
2. Refer to applicable contract drawings and specifications pertaining to other Divisions for conditions affecting work.

B. Definitions: Refer to Division 01, "References " Section for definition of terms.

1.11 OPERATION AND MAINTENANCE REQUIREMENTS

A. Provide Operation and Maintenance Manuals in accordance with Section 01 78 22, “Operation and Maintenance Manuals”.

1.12 WARRANTY

A. Deliver to the Owner certificates of equipment warranty extending beyond the guarantee period.

PART 2 - PRODUCTS

2.1 PAINTING

A. Painting of piping and equipment is included under another Division unless otherwise indicated.

B. Schedule

SURFACE	COATS	MATERIAL
Concealed Piping, etc.	1	Primer equivalent to Glidden Devguard 4160

C. Colors for indoor exposed surfaces will be selected by the Architect.

2.2 ACCESS PANELS

A. Access panel products are specified in Division 08, “Access Panels and Frame”.

B. Steel: Prime coated, flush screwdriver operated cam action lock. Minimum size 12 by 16 inches (300 by 400 mm), except as otherwise specified.

C. Frame must have anchor lugs for fastening to construction.

D. Access panels in plaster and gypsum board surfaces must be solid flush steel. Frame must have 2-inch (50-mm) wide lath plaster bond or for gypsum board, a joint compound bead.

E. Provide UL "B" labeled doors or panels in walls and building elements constructed for a 2-hour fire resistant rating.

F. Manufacturers: C.E. Sparrow (CESCO), Bilco, Elmdor, Karb, Milcor, Zurn, equal Milcor Styles AP, AT, K, M, and "B" label.

2.3 FLASHING

A. Flashing Material:

1. Chloroloy 240.

B. Counterflashing: 26-gage (0.55-mm) galvanized steel or 16-ounce per square foot (4.9 kg per square meter) soft sheet copper.

2.4 HANGER ATTACHMENT - Application and Type

A. NFPA Compliance: Comply with NFPA 13.

B. UL Compliance: Comply with UL 203.

C. Concrete (New): Iron or steel inserts. Expander type anchors, specified for existing may be used provided concrete is clear of conduit for drilled depth.

D. Concrete (Existing): Double plated expander type anchors. Phillips, Hilti or approved equivalent. Loads must not exceed 1/4 of tested pullout (or shear) strength.

E. Precast Concrete Plank: Drill hole through plank; bolt hanger rod to 4-by-4-by-1/8-inch (100-by-100-by-3-mm) steel plate on top of plank.

F. Steel Beams: Iron or steel beam clamps.

G. Wood Beams: Light duty, screws; heavy duty, bolted bracket.

H. Brick or Block Walls: Brackets fastened with self-drilling anchors or toggle bolts, light duty; or through bolts with backplates, heavy duty.

2.5 SLEEVES AND ESCUTCHEON PLATES

A. Coordinate with Section 07 84 13, "Penetration Firestopping" for penetration firestopping installed in fire-resistance rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

B. Sleeves for Piping and Conduits - Material and Application

1. Type 304, 18-Gage (1.2-mm) Stainless Steel butt welded entire length of seam for floors without membrane waterproofing:

C. Escutcheon Plates for Piping: Chromeplated brass.

D. Sealant

1. One part polysulfide, equivalent to Pecora Synthacaulk GC24 or polycarbonate, equivalent to Proseal 34for general use.
2. Acoustical sealant is specified in Division 07.

E. Grout

1. Non-shrink, recommended for interior and exterior sealing openings in non-fire rated walls or floors.
2. ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic cement grout.
3. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.
4. Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PAINTING

A. Painting of piping and equipment exposed to view is included under another Division unless otherwise indicated.

B. Paint exposed piping, conduit, wire troughs, junction boxes, backboxes, equipment in mechanical equipment rooms and elsewhere as indicated.

C. Paint miscellaneous ironwork which is not copper, galvanized, aluminum, and stainless steel.

D. Touch-up scratches and marred places on factory painted equipment to match finish.

3.2 ACCESS PANELS

A. Provide access panels or doors that are indicated or required for access to control devices and to concealed fire suppression and associated electrical devices which may require future inspection, repair or adjustment; and elsewhere as required by applicable codes. Installation of panels is specified in another Division.

B. Use ceiling element as access panel in suspended metal pan, lay-in panel, and accessible tile ceilings.

C. Attach a 1/4-inch (6-mm) diameter color-coded aluminum tag to exposed grid tees or ceiling elements used as access panels and recessed pan doors. Coordinate identification with Section 21 05 53, "Identification for Fire Suppression Piping and Equipment."

D. Provide UL listed/rated access panels where panels are required for access to equipment located within floor-ceiling or roof-ceiling assembly.

3.3 FLASHING

A. Flash conduits and pipes projecting through roof or outside walls. Make watertight seal to roof material and pipe or conduit. See Division 07.

B. Protect sleeve packing and flashing joints with counterflashing. Solder or weld counterflashing to pipe or conduit. Clean joint and coat with zinc dust paint. See Division 07.

3.4 HANGER ATTACHMENT

A. Select and install structural attachments for hangers supporting pipes, conduit, and equipment adequately for stresses to which they may be subject and for proper distribution of load to building structural members.

3.5 SLEEVES AND ESCUTCHEON PLATES

A. Sleeves are not required for core-drilled holes except where sleeves are specified and required to extend above the floor.

B. Sleeves are not required for floor slabs on-grade.

C. Install sleeves for pipes and conduits passing through roofs, floors, plaster ceilings, gypsum board ceilings, walls, partitions, structural members, and other building parts. Install sleeves in time to permit construction progress as scheduled.

D. Install sleeves with length to pass through full thickness of construction.

E. Provide 1/2-inch (15-mm) minimum clearance between sleeve and conduit, pipe, or covering. Center conduit or pipe in sleeve unless otherwise indicated.

1.

F. Install ends of sleeves flush with finished wall surfaces.

G. Cut sleeves to length for mounting flush with both surfaces except, extend floor sleeves for exposed conduits and pipes 2-inch (50-mm) above finished floor.

H. Reinforce sleeves temporarily, if necessary, to preserve accurate shape without distortion during construction.

I. Grout sleeves in concrete floors, concrete roof slabs and concrete walls into building structure to make joint watertight.

J. Install escutcheon plates for pipes and conduits at floors, ceilings, walls, and partitions in finished areas unless otherwise indicated.

1. Fit escutcheons around conduit.
2. Outside diameter must cover sleeve.
3. Where sleeve extends above finished floor, cover sleeve extension with escutcheon.
4. Install one-piece escutcheons for new piping.
5. Install split-plate escutcheons on existing piping.

K. Pack annular space between sleeve and conduit or pipe and voids between building construction and conduit, pipe, or sleeves as follows:

1. Firestop equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, for the following sleeve locations:

a. Where vermin control is indicated.
b. Roof and walls with waterproofing.
c. Acoustically rated walls, floors and ceilings.

2. For the following locations, pack annular space between sleeve and conduit or pipe and voids between building construction and conduit or pipe sleeves with industrial felt fire material equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, or code approved firestopping foam, caulk, or putty that meets ASTM E-814 with UL classification firestopping sealant as specified in Division 07. Sealants must not contain toxic or flammable solvents and must not produce toxic or flammable out-gasing during any stage of application, curing, drying or fire conditions.

a. Floors

L. Vermin Control: Provide vermin control for conduits or pipes passing through ceilings, walls, and partitions.

M. Prime surfaces prior to caulking to obtain good adhesion where recommended by sealant manufacturer.

N. Install pipe penetration seals on pipes passing through underground walls and floors as recommended by the manufacturer. Installation must result in a watertight and electrically insulated seal.

O. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

1. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.6 PROJECT RECORD DOCUMENTS

A. Maintain at the site one set of black or blue line on white prints of drawings, copies of specifications, addenda, shop drawings reviewed by Engineer, change orders and other modifications in good order and marked in red ink to record changes made during construction. Deliver these in final complete form to the Architect upon completion of work.

3.7 SITE EXAMINATION

A. Failure to visit site and become familiar with local conditions prior to bidding will not relieve the Contractor of their responsibility for complying with the Contract Documents.

3.8 CUTTING AND PATCHING

A. Unless otherwise directed, do cutting and patching. Repair damaged fireproofing and waterproofing to original or better condition.

B. Do not cut walls, floors, reinforced concrete or structural steel without Engineer's permission. Install services without affecting reinforcing steel.

C. In precast concrete plank, drill holes with a carboloy tipped drill. Follow instructions of plank manufacturer. Cut no reinforcing bars.

3.9 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 debris in containers and promptly remove them from the Owner's property.

3.10 DEMOLITION

A. Selective demolition is specified under another Division.

3.11 WORK IN EXISTING BUILDINGS

A. Conditions of Occupancy

1. This building will be occupied during the life of this contract. Execute work in a manner to impose minimal interference with the normal functioning of the building and its occupants. When interference is unavoidable, schedule work 14 days in advance with the Owner.
2. Make temporary connections where necessary to maintain uninterrupted electrical and fire suppression service.
3. Provide adequate protection for the building, its contents, and occupants.
4. Perform work as quietly as possible to avoid unnecessary disturbance. Unusual precaution may be necessary in the conduct or work in some areas to achieve satisfactory compliance.
5. Coordinate with Owner to perform masonry demolition or other work producing high noise levels, dust, or hazards to occupants in occupied areas.
6. Comply with regulations of Owner pertaining to circulation, sanitation, and behavior of Contractor's personnel.

B. Interruption of Existing Water Service:

1. Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

    a. Notify Owner no fewer than 14 days in advance of proposed interruption of water service.
    b. Do not interrupt water service without Owner's written permission.

C. Field Office, Storage, and Loading Facilities

1. Provide office and storage facilities where designated by the Owner.
2. Provide adequate furnishings including file space, lighting, telephone, and heat where necessary.
3. Use only those toilet facilities designated by the Owner for use by Contractor's personnel.
4. Store equipment and materials in areas designated by Owner in a manner which will not (a) cause concentrations of weight potentially damaging to building structure, (b) impede normal building traffic, or (c) be a hazard to occupants.
5. Use only the entrance designated by the Owner for delivery and removal of materials. Schedule deliveries and removals with the Owner in advance. Unscheduled traffic must give precedence to Owner's usage. Do not impede access through doorways and corridors with materials, containers, or parked conveyances.
6. Use only rubber wheeled wheelbarrows, dollies, or carts over finished floors.
7. Keep office, storage, and loading areas neat and clean.

D. Barricades

1. Erect temporary barriers for protection of occupants, building, and building contents.
2. Where partitions separating occupied areas must be cut, close hole with tight fitting temporary plywood closure panel, 1/2-inch (13-mm) minimum thickness, to form visual and acoustical barrier.
3. Protect exposed holes in floors in accordance with applicable codes and regulations.

4. Enclose dust-producing operations with plastic sheets or drop cloths to prevent the spread of dust into occupied areas. Maintain a negative pressure environment relative to the surrounding spaces.

    a. Take the necessary precautions to prevent the spread of dust and dirt through the existing HVAC system, including outdoor intakes. Protect new and existing return and exhaust air openings.

E. Alterations

1. Cut, alter, remove or temporarily remove and replace existing work necessary for installation of fire suppression and associated electrical work. Maintain the necessary clearances for accessibility or compliance with code around existing equipment, devices, etc., that are to remain.
2. Verify dimensions of existing building elements pertaining to the installation of new work to assure physical compatibility prior to fabrication or installation.
3. Where the installation of new services or the extension of existing services requires cutting of existing floors, walls, partitions, etc., check for the presence of existing fire protection, plumbing, mechanical and electrical services within or immediately beneath construction and exercise necessary precautions to prevent damage to the service or injury to personnel due to contact with same. Where practical, temporarily disconnect such existing service during the cutting operation. Schedule such outages in service with the Owner, 14 days in advance.

F. Removal of Materials and Equipment

1. Remove promptly from the site, materials and equipment specified to be removed and not reinstalled or stored.
2. Unless otherwise indicated, removal of pipes, and equipment includes removal of accessories such as hangers, piping connections, junction boxes, etc. Remove to source or, if concealed, to point of concealment, connections to fire suppression equipment required to be removed or disconnected. Terminate connections behind finished surfaces and, if subject to movement, clear of building construction. Cap connections extending from piping remaining in service.

G. Connections to Existing Systems

1. Connect to existing systems as indicated.
2. Obtain permission from Owner 14 days in advance if outage of service is necessary to make connections. See the Article titled, "Outages."

3.12 PROTECTION

A. Protect fire suppression and associated electrical material and equipment from the elements or other injury as soon as delivered on premises.

1. Accept in original packaging.
2. Store in clean, dry space.
3. Protect from dirt, water, construction debris, and traffic.

4. Handle in accordance with manufacturer's written instructions.

B. Cap or plug openings in equipment, piping, and conduit systems, to exclude dirt and other foreign material. Do not use rags, wool, cotton, paper, waste or similar materials for plugging.

C. Existing components of the building and its systems must be protected from damage. Any damage to these components must be repaired or replaced to the satisfaction of the Owner. Special care must be taken with regards to insulation on existing piping and ductwork. Damaged insulation must be replaced so that the vapor barrier and insulating characteristics of the material match those prior to damage taking place.

3.13 CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior are free of foreign matter.

B. Leave strainers and dirt pockets in clean condition.

C. Pay for labor and materials required to locate and remove obstructions from systems clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

D. Leave systems clean, and in complete running order.

3.14 EQUIPMENT SUPPORTS

A. Provide equipment supports consisting of platforms, curbs, concrete pads, gratings, cradles, structural members, hangers, rods, racks, and incidental materials.

1. NFPA approved, UL listed, or FM approved welded, shop or field fabricated equipment support, made from structural, carbon steel shapes.

B. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas.

C. Concrete Equipment Pads

1. Provide concrete pads not less than 4 inches (100 mm) high and projecting not less than 3 inches (75 mm) on all sides beyond equipment for floor mounted equipment.
2. Place anchor bolts in steel pipe sleeves, with a plate at bottom end of sleeve to hold bolts.
3. Grout between base plate and foundation.

D. Floor Mounted Stands: Construct with structural steel members or steel pipe and fasten with flanges bolted to floor.

E. Curbs: Construct concrete curbs 4 inches (100 mm) high and 6 inches (150 mm) wide unless otherwise indicated.

F. Ceiling Suspended Platforms: Construct with steel hangers. Brace and fasten to building structure.

G. Wall Mounted Platforms: Construct with steel brackets.

H. Saddles for Tank Supports: Cast iron or welded steel of curvature to fit tank. Locate supports to avoid undue strain on shell and interference with pipe connections to tank outlets.

3.15 DEMONSTRATION AND TRAINING

A. Provide operating and maintenance staff demonstrations and training in accordance with Section 01 82 00, "Demonstration and Training".

1. Provide a walking tour, demonstrating all new fire suppression equipment, system layout, routing and labeling.

B. Upon completion of work, instruct Owner's representatives in the proper operation and maintenance of the fire suppression system.

C. Instruction periods specified below shall be in addition to instructions specified for certain items elsewhere in the specifications.

D. Instructions shall be given by persons expert in the operation and maintenance and must be for a period of not less than one 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.

3.21 CONTRACTOR TESTS

A. Contractors' tests must be scheduled and documented in accordance with the Commissioning requirements. Refer to Section 01 91 00, for further details.

3.22 VERIFICATION TESTING

A. System verification testing is part of the Commissioning process. Verification testing must be performed by the contractor and witnessed and documented by the Commissioning Authority. Refer to Section 01 91 00, or system verification tests and commissioning requirements.

3.23 OUTAGES

A. The purpose of this article is to establish standard procedures for requesting an outage for fire suppression, electrical, or operational systems or services associated with the building.

B. An outage is defined as prohibiting or restricting a fire suppression, electrical or operational service from routine operation. For purposes of repair, replacement or connection to an existing system, this standard must be followed.

C. All systems, when shutdown, must be tagged in accordance with OSHA lock-out/tag-out procedures.

D. Minimize the number and duration of all outages.

E. A master outage list, with the approximate required dates, must be submitted to the Owner within 14 days from the commencement of work.

END OF SECTION 21 05 00

SECTION 21 13 00 - FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Fire suppression system includes all piping, sprinklers, test and drain lines, pressure gages, hangers and supports, and other such standard appurtenances as required for a complete installation.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Division 10 Section Fire Protection Specialties for Fire Extinguishers, Cabinets, and Accessories

C. Section 21 05 00 – Basic Fire Protection Materials and Methods

D. Section 22 40 00 - Plumbing Fixtures and Equipment

E. Section 23 05 00 - Basic Mechanical Materials and Methods

F. Section 23 20 00 - Building Services Piping

G. Division 26 – Electrical

H. Division 28 – Fire Alarm

1.3 QUALITY ASSURANCE

A. Fire suppression system shall be installed by a licensed sprinkler contractor.

B. All work, materials, equipment, installation and accessories shall comply with the standards of the National Fire Protection Association, and all state and city regulations.

C. Wiring connections and voltage for water flow, pressure, and valve supervisory positions shall be suitable for connections to the building fire alarm system.

1.4 ACTION SUBMITTALS

A. Submit in accordance with Division 01 and Section 21 05 00.

B. Manufacturer's technical product data, installation instructions, and accessories:

Sprinklers
Wet Sprinkler System Devices

C. Delegated Design Submittals: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation or prepared by NICET Level III-certified technician, "Water-Based Systems Layout." NICET certified-technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, and NICET certification specialty area and level.

D. Sprinklers shall be referred to on submittals and other documentation by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be permitted.

E. Hydrant flow test data.

F. Prior to commencement of associated work, submit sprinkler system hydraulic calculations and coordinated piping system shop drawings including location of sprinklers, valves, alarms, test connections, drains, etc. coordinated with mechanical, electrical, structural and building elements.

G. Sprinkler system test reports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Qualification Data: For qualified Installer and professional engineer or NICET certified technician].

C. Design Data: Approved sprinkler piping working plans, prepared according to NFPA 13, including documented approval by authorities having jurisdiction, and including hydraulic calculations if applicable.

1.6 APPLICABLE PUBLICATIONS

The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.7 PROJECT CONDITIONS

A. The hose connection at each fire department valve and fire department connection shall have outlet size and threads conforming to those used by the Baltimore City Fire Department.

B. Provide all material and equipment necessary for a complete system of fire protection as indicated on the drawings and as specified herein.

C. Wet Sprinkler System: Provide automatic wet pipe sprinkler system throughout all areas of the building project area. Wet pipe system shall be complete in all respects and ready for operation including all test and drain lines, pressure gages, hangers and supports, signs and other standard appurtenances.

PART 2 - PRODUCTS

2.1 SPRINKLER SYSTEM

A. Manufacturers: Grinnel (GEM), Reliable Sprinkler Co., Star Sprinkler Corp., Viking, Central Sprinkler Corp., Victaulic.

B. Provide spray type sprinklers. Sprinklers shall be used in accordance with their listed spacing limitations. Sprinklers with internal O-rings are not acceptable. In general, sprinklers shall be of the fusible strut or frangible glass bulb type and of ordinary temperature rating. Sprinklers located within the air streams of unit heaters or other heat emitting equipment and those in high heat areas such as boiler rooms, etc. shall be selected for proper temperature rating.

C. Quick response sprinklers shall be used in Light Hazard area locations.

D. Entire sprinkler system shall be drainable. Return bends shall be used to avoid traps in the sprinkler system.

E. Sprinkler Types

1. Exposed Upright sprinkler shall have a finish selected by the Architect.
2. Pendant Sprinkler with Recessed Escutcheon: Pendent sprinklers shall have a finish selected by the Architect. Escutcheon shall be recessed type with finish selected by the Architect.
3. Pendent Sprinkler with Concealed Cover: Concealed pendent sprinklers with brass finish shall provide the appearance of a smooth ceiling with the sprinkler hidden from view by a low profile coverplate flush with the ceiling. Cover plate shall be removable without affect on sprinkler. Cover plate shall have a finish selected by the Architect.
4. Sidewall sprinkler shall be quick response type. Sidewall sprinkler shall have a white enamel finish. Escutcheon shall be recessed type with a factory white enamel finish.
5. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
6. Coordinate with and obtain approval of all sprinkler and escutcheon finish types with Architect during the submittal phase.

F. Provide sprinkler coverage around fixed obstructions, such as large ducts, in accordance with NFPA 13.

G. Spare Sprinklers and Cabinet: Provide spare sprinklers in accordance with NFPA 13. Sprinklers shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

PART 3 - EXECUTION

3.1 SPRINKLER SYSTEM

A. Sprinkler system shall be hydraulically designed unless otherwise noted on the drawings. Sprinkler spacing in general and water quantity shall be based on Hazard Occupancy indicated on drawings.

B. Conduct a hydrant flow test to determine available pressure. Perform test during periods of heavy usage of the public water main.

C. Provide piping from fire department test connection to drainage system.

D. Fire protection mains, branch sprinkler piping and sprinklers are not shown. The Contractor shall be responsible for the location of pipe, sprinklers, and the sizing of the mains, and branch sprinkler piping.

E. Submit shop drawings showing the complete piping system including location of sprinklers, piping, etc., completely coordinated with mechanical, electrical and structural systems prior to commencement of work.

F. Sprinklers installed in ceilings of finished areas shall be symmetrical in relation to ceiling systems components centered in tile and coordinated with other equipment in the ceiling. Submit typical layouts to Architect for review.

G. Sprinklers shall be generally installed in accordance with NFPA13 except additional sprinklers shall be provided to satisfy requirements of symmetry or aesthetics.

H. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protector carefully by hand after installation. Do not use any tools to remove bulb protectors.

I. Sprinklers subject to mechanical injury shall be protected with guards. Provide guards on sprinklers located in mechanical and electrical equipment rooms and where required by NFPA 13.

J. Piping in spaces with ceilings shall be concealed in the ceiling space. Install sprinklers at a uniform projection distance from ceiling. Sprinkler piping installation shall be such that access to the ceiling space is not impaired.

K. Hydraulic calculations shall be prepared and submitted to the Authorities Having Jurisdiction before submitting to Engineer for review.

L. Sprinkler Cabinet: Locate where directed, but not where sprinklers will be subjected to temperatures exceeding 100 degrees F.

3.2 APPROVAL AND TESTING

Arrange for approval of sprinkler systems and conduct tests in accordance with NFPA 13.

END OF SECTION 21 13 00

SECTION 23 05 00 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Requirements of this Section are applicable to work in Division 21 and 23.

B. Contract Documents

1. Unless otherwise modified, drawings and general provisions of the Contract, including provisions of General Conditions and Division 01 govern work under Divisions 21 and 23.
2. Contract drawings for fire suppression and mechanical work are diagrammatic, intended to convey scope and general arrangement.
3. Refer questions involving document interpretation or discrepancies to the Owner for review and direction.
4. Specifications establish quality of materials, equipment, workmanship and methods of construction.
5. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

C. Scope

1. The work in Divisions 21 and 23 includes furnishing and installing the fire suppression and mechanical work complete and ready for satisfactory service.
2. Requirements specified govern work in and all sections of Divisions 21 and 23.
3. Some of the work described in this Section is also applicable to the scope of Divisions 26 and 28.

1.2 RELATED DIVISIONS

A. Division 01 - General Requirements

B. Division 21 – Fire Suppression

C. Division 23 – Heating, Ventilating, and Air Conditioning

D. Division 26 – Electrical

E. Division 28 – Electronic Safety and Security

1.3 QUALITY ASSURANCE

A. Regulations: Comply with regulations of NFPA, state, and municipal building ordinances, and other applicable codes and regulations.

B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

C. Material and Equipment Requirements

1. Use products of one manufacturer where two or more items of same kind of equipment are required.
2. Materials and equipment shall have a record of one-year successful field use.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which, the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.

D. Workmanship

1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate work and cooperate with other trades to facilitate execution of work.

E. Coordination with Other Trades

1. Contractor shall give full cooperation and coordination with other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
2. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordination adjacent work.

F. Asbestos or asbestos-containing materials shall not be utilized or allowed on this project. The Contractor shall be rigorous in assuring that all materials, equipment, systems, and components do not contain asbestos. Any deviations from this exclusion shall be remedied at the Contractor’s expense without regard to prior submittal approvals.

G. Access: The Contractor shall specifically consider all materials and equipment installations and shall coordinate with the work of all trades to insure easy and unobstructed accessibility of all systems for operations, maintenance, repairs, and replacement. Installation of all specified materials and equipment including but not limited to, equipment, supports, ductwork, pipe, and controls shall be in a manner which will allow complete unobstructed access to all panels, access doors, filter racks, control boxes, controls actuators, sensors, valves, tube bundles and all other items requiring access for operations or maintenance. Any installation of new equipment or materials which causes problems related to access of new or existing equipment shall be disapproved by the Owner and re-accomplished by the Contractor.

H. Wood Truss Construction: This project includes wood truss construction for floor-ceiling assemblies and roof-ceiling assemblies. Coordinate the installation of all equipment, fixtures, piping, and ductwork, within the truss space and with the actual construction of the trusses and final installed locations of trusses. Provide offsets as required to coordinate with trusses and other trades. Provide UL-rated access panels for each device that requires access.

1.4 SUBMITTALS

A. Manufacturer's technical product data, installation instructions and description of accessories for each type to be used and system designation:

1. Concrete compressive strength test.
2. Motors and power factor correction capacitors (submit under section specifying related equipment).
3. Layout Drawings for equipment supports.
4. Identification.
5. Operating and maintenance manuals.
6. Statement of field instruction completion.

1.5 APPLICABLE PUBLICATIONS

The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. References

1. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
2. Refer to applicable contract drawings and specifications pertaining to other Divisions for conditions affecting work.

B. Definitions: The following are definitions of terms and expressions used in Divisions 22 and 23.

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 Owner.
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. “Furnish” - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.
8. “Indicated” - indicated in Contract Documents.
9. “Install” - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.
10. “Piping” - includes pipe, fittings, valves, supports and accessories comprising a system.
11. “Provide” - furnish and install, complete and ready for the intended use.
12. “Removable” - detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.
13. “Review” - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

B. Refer to Division 1 Section, "References" for additional definition of terms.

1.7 WARRANTY

Deliver to the Owner certificates of equipment warranty extending beyond the guarantee period.

PART 2 – PRODUCTS

2.1 CONCRETE WORK

A. Compressive Strength: 3000-psi minimum after 28 days.

B. Reinforcing Steel: Yield strength as determined by structural design.

C. Grout: Non-shrink, non-metallic, pre-mixed, equivalent to Nordbak Fast-set, U.S. Grout Five-star, or Polymeric.

2.2 MOTORS AND ELECTRICALLY OPERATED EQUIPMENT

A. References, Characteristics and Ratings

1. Refer to Electrical Division for requirements of electrical work including starters specified in the Mechanical Division.
2. Provide motors and other equipment requiring electrical power or control service suitable for the electrical characteristics indicated on the Electrical Drawings.
3. Horsepowers indicated are for manufacturer's equipment upon which the specification is based. Submit proposed deviations from these ratings for review by the Owner. Pay costs incurred by deviations, which are permitted.
4. Provide motor rated for 200 volts for 208-volt service. Provide 230 and 460-volt rated motors for 240 and 480-volt service.
5. Brake horsepower at specified duty shall not exceed 85 percent of nameplate horsepower times NEMA service factor for motors with 1.15 service factor except where other limits are stated for certain equipment, i.e. fans, the maximum load percentage shall be as stated under that equipment times the 1.15 service factor. For water or refrigerant cooled motors driving compressors the maximum load percentage shall be 78 percent, 72 percent and 70 percent, for motors with 1.25, 1.35, and 1.4 service factors, respectively.

    a. For motors operating in ambient conditions of 50 degrees C or above, service factor shall be 1.00.

6. Motors controlled by variable frequency drives (VFD) shall be inverter type motors, compatible and suitable for operation with the VFD provided for this project.

    a. Horsepower of VFD shall be same as motor.

B. Overload Protection

1. Protect each motor, either individually mounted or in unitary equipment, with overload devices such as fuses, thermal cutouts, or thermal protectors installed in each ungrounded

conductor serving each motor. Mount these overload devices in the motor controller or in a control panel in unitary equipment.

2. For equipment that requires the use of fuses, provide the proper size and type of fuses mounted on accessible fuse blocks, integral to the equipment, wired in accordance with applicable codes.

C. Construction

1. Construct motors in accordance with NEMA Standard Publication MG-1, latest edition, and the applicable IEEE standards.
2. Frame sizes in accordance with NEMA Standard MG-1 and MG-13, latest editions.
3. Starting torque, NEMA Design B, 2-4 percent slip.
4. Starting (locked rotor) kVA as required by the driven equipment. On motors with a locked rotor indicating code letter of "F" or higher, the manufacturer shall notify the electrical contractor for circuit breaker adjustment in accordance with Division 26, “Electrical.”
5. Outdoor, Exposed Motor: Totally enclosed fan cooled construction, 1.15 service factor, stator windings totally encapsulated having non-hygroscopic insulation approved for outdoor use, and double shielded bearings.
6. Rotor: Random-wound, squirrel cage.

D. Insulation: NEMA Insulation Class B for operation in 40 degrees C ambient; except NEMA Premium efficient motors and motors used in conjunction with variable frequency drives shall be NEMA Class F insulation with horsepower based on Class B rise.

Where motors operate in a maximum ambient temperature above 40 degrees C, provide motors suitably designed for the ambient temperature indicated, employing a different class of insulation or having a change in frame size, i.e., the ambient temperature plus motor full load temperature rise plus 10 degrees C shall not exceed the temperature rating of the insulation system.

E. Power Factor Correction Capacitors: Three-phase, rated for the applied circuit voltage, fused at 5 KVAR's and above. Employ non-PCB impregnated paper or film dielectric and insulation; installed in indoor dustproof NEMA Type 12, or outdoor NEMA Type 3R enclosure, depending on location; contain maximum of 3 gallons of a combustible insulating liquid; equipped with integral discharge resistors to reduce voltage to a maximum of 50 volts in three minutes.

Power factor correction capacitors shall be sized by the motor manufacturer. List the capacitor KVAR, the full load current of the motor-capacitor combination to enable proper sizing of the overload protection and the corrected power factor at no load and full load on the shop drawings for the equipment. Do not provide power factor correction capacitors for motors served by a variable frequency drive or motors with reduced voltage starting. Do not provide power factor correction capacitors for fans that have dual motors mounted on a single common shaft and with other drive arrangements that rotate both motors.

1. Individual single speed, non-reversing motors, 5 HP and larger, having a full load power factor of less than 90 percent, shall be supplied by the equipment supplier, with power factor correcting capacitors that correct the full load power factor of the circuit to a minimum of 90 percent and the no load power factor to a maximum of unity.

2. On single speed, non-reversing motors started by reduced voltage controllers such as star-delta, auto transformer, primary resistor, etc., provide necessary contactors and interlocks

to prevent insertion of capacitor until controller and motor are operating in the full run mode. Full load power factor of the circuit shall be a minimum of 90 percent.

3. On package or unitized equipment on which motors and controls are factory wired up to a point or points of power connection, install and connect power factor correction capacitors to the motor circuits between the starters and the motors, as part of the factory supplied assembly.

F. Electronically Commutated (EC) Motors

1. Motor shall be direct drive motor.
2. Motor shall be variable speed, DC, brushless type specifically designed for pump applications and include heavy duty ball bearings and electronic commutation.
3. Motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.
4. Motor shall be complete with, and operated by, a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator.
5. All EC Motors shall be designed for synchronous rotation.
6. Motor rotor shall be permanent magnet type with near zero rotor losses.
7. Motor shall be able to be mounted with shaft in horizontal or vertical orientation.
8. Motor shall have permanently lubricated ball bearings.
9. Motor shall include inductors to minimize harmonic distortion and line noise.

G. Single Phase Motors

1. 1/6 Horsepower or Less: Split phase capacitor start, permanent split capacitor or resistance start, capacitor run.
2. 1/4 and 1/3 Horsepower: Capacitor starts.
3. Bearings: "Life-time" sealed ball bearing type, oilable ball bearing or sleeve type for radial and thrust loading.
4. High efficiency energy saving type with a minimum efficiency of 70 percent and a minimum full load power factor of 77 percent.

H. Three Phase Motors:

1. NEMA Premium efficiency polyphase induction type.
2. Minimum full load power factor before power factor correction of horizontal and vertical shaft motors shall be as follows:

HP	RPM	Kw	RPS	POWER FACTOR
1/2	3600 and 1800	0.37	60 and 30	70 Percent
3/4	3600 and 1800	0.56	60 and 30	70 Percent
1, 1-1/2 and 2	3600 and 1800	0.75, 1.10 and 1.50	60 and 30	79 Percent
3 to 20	3600 and 1800	2.20 to 50.00	60 and 30	85 Percent

3. Minimum full load efficiency (in percent) of horizontal and vertical shaft motors shall be follows:

Open Dripproof (ODP) Motors

HP	KW	1200 RPM (20 RPS)	1800 RPM (30 RPS)	3600 RPM (60 RPS)
		Minimum Full Load Efficiency (%) (6-Pole)	Minimum Full Load Efficiency (%) (4-Pole)	Minimum Full Load Efficiency (%) (2-Pole)
1	0.75	82.5	85.5	77.0
1-1/2	1.10	86.5	86.5	84.0
2	1.50	87.5	86.5	85.5
3	2.20	88.5	89.5	85.5
5	3.70	89.5	89.5	86.5
7-1/2	5.60	90.2	91.0	88.5
10	7.50	91.7	91.7	89.5
15	11.20	91.7	93.0	90.2
20	15.00	92.4	93.0	91.0

NOTE: Efficiencies are nameplate ratings and must be tested in accordance with IEEE Standard 112, Method B.

Totally Enclosed Fan Cooled (TEFC)

HP	KW	1200 RPM (20 RPS)	1800 RPM (30 RPS)	3600 RPM (60 RPS)
		Minimum Full Load Efficiency (%) (6-Pole)	Minimum Full Load Efficiency (%) (4-Pole)	Minimum Full Load Efficiency (%) (2-Pole)
1	0.75	82.5	85.5	77.0
1-1/2	1.10	87.5	86.5	84.0
2	1.50	88.5	86.5	85.5
3	2.20	89.5	89.5	86.5
5	3.70	89.5	89.5	88.5
7-1/2	5.60	91.0	91.7	89.5
10	7.50	91.0	91.7	90.2
15	11.20	91.7	92.4	91.0
20	15.00	91.7	93.0	91.0

NOTE: Efficiencies are nameplate ratings and must be tested in accordance with IEEE Standard 112, Method B.

Measure motor efficiencies as tested in accordance with ANSI/IEEE Standard 112, Test Method B. Do not extrapolate efficiencies from other data. Measure each kilowatt rated size. Submit test data from certified independent testing laboratory of standard manufacturer run per kilowatt rated size.

I. Bearings and Bases

1. Motors 1/2 through 2 Horsepower: Sealed "life-time" ball bearing or regreaseable ball bearing type with minimum life of 25,000 hours under "V" belt load conditions.
2. Motors 3 through 20 Horsepower: Anti-friction bearings sized for a minimum life of 25,000 hours under “V” belt load conditions or a minimum life of 100,000 hours for a direct connected load. House bearings in a re-greaseable race with provision for purging

old grease. Preload bearings with a bearing load spring to minimize noise and increase bearing life suitable for radial and thrust loading.

3. Motors for Belt Drive: Cast iron or steel base with slide rails having screw adjustments.

2.3 HANGER ATTACHMENT - Application and Type

A. Concrete (Existing): Double plated expander type anchors. Phillips, Hilti or approved equivalent. Loads shall not exceed 1/4 of tested pullout (or shear) strength.

B. Steel Beams: Iron or steel beam clamps.

C. Brick or Block Walls: Brackets fastened with self-drilling anchors or toggle bolts, light duty; or through bolts with backplates, heavy duty.

D. Wood Beams: Light duty, screws; heavy duty, bolted bracket.

2.4 SLEEVES AND ESCUTCHEON PLATES

A. Sleeves for Piping and Conduits - Material and Application

1. 22 Gage Galvanized Steel:
   a. Stud partitions.
   b. Suspended plaster and gypsum board ceilings.

2. Galvanized Standard Weight Steel Pipe with Anchor Flange Welded to Perimeter:
   a. Exterior concrete walls.
   b. Exterior masonry walls.

3. Galvanized Standard Weight Steel Pipe or Galvanized Cast Iron Pipe, with Integral Membrane Clamping Ring and Brass or Cadmium Plated Bolts:
   a. Floors with membrane waterproofing.
   b. Roofs with membrane waterproofing.

B. Escutcheon Plates for Piping: Chromeplated brass.

C. Sleeves for Ductwork: 20 gage galvanized steel.

D. Sealant: One part polysulfide, equivalent to Pecora Synthacaulk GC24 or polycarbonate, equivalent to Proseal 34 for general use.

E. Grout

1. Non-shrink, recommended for interior and exterior sealing openings in non-fire rated walls or floors.
2. ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic cement grout.
3. Design Mix: 5,000-psi (34.5 MPa), 28-day compressive strength.
4. Premixed and factory packaged.

2.5 IDENTIFICATION

A. Labels: WH Brady B-946 vinyl cloth pipe markers, 3/4-inch pipe banding tape with 1/2-inch wide tape to wrap the circumference of the pipe. Match color of tape with marker.

B. Nameplates: Laminated phenolic plates, 1/8-inch thick, with beveled edges and engraved 1/4-inch high block, capital white letters on a black background.

C. Wire Markers: Self-sticking W. H. Brady Co. Perma Code wire markers.

D. Flow Arrows: W.H. Brady Pipe Marker arrows Stock No. 91000 Series to identify the direction of flow in the pipe or duct. Match color with service marker for the system. One-inch arrow tape for marker Style 4; two-inch arrow tape for marker Style 1; four-inch arrow tape for marker Style 1HV; and Style 3C arrow tape for marker Style 3C.

PART 3 – EXECUTION

3.1 CONCRETE WORK

A. Location: Equipment foundation pads, equipment housekeeping pads, vibration isolation inertia bases, and where indicated under mechanical and electrical work.

B. Perform work in conformance to American Concrete Institute Standard ACI 301-72, Specifications for Structural Concrete for Buildings.

C. Bond new work by roughing existing surface to expose aggregate uniformly, then cleaning surface.

D. Bevel exposed vertical and horizontal edges 3/4-inch.

E. Install grout according to manufacturer's recommendations.

F. Testing: Test concrete using a qualified testing agency.

3.2 MOTORS

A. Align motor, drives, and driven equipment to avoid excessive strain or wear.

B. Check belt tension with a tension tester for the deflection force recommended by the manufacturer. Check and adjust tension after several minutes operation and then after eight hours of operation.

C. Power factor correction capacitors for individual motors are installed and connected under the Electrical Division. Coordinate with the Electrical Contractor.

D. Install shaft grounding ring on shaft of motors served by variable frequency drives in accordance with manufacturer’s recommendations and instructions.

3.3 HANGER ATTACHMENT

Select and install structural attachments for hangers supporting pipes, ducts, conduit and equipment adequately for stresses to which they may be subject and for proper distribution of load to building structural members.

3.4 SLEEVES AND ESCUTCHEON PLATES

A. Sleeves are not required for core-drilled holes except where sleeves are specified and required to extend above the floor.

B. Install sleeves for pipes and conduits passing through plaster ceilings, gypsum board ceilings, walls, partitions, structural members, and other building parts. Install sleeves in time to permit construction progress as scheduled.

C. Install sleeves for ducts passing through roofs, walls, plaster ceilings, gypsum board ceilings, floors, and partitions as follows:

1. Where vermin control is indicated.
2. Roofs and Walls with waterproofing

D. Install sleeves with length to pass through full thickness of construction.

E. Provide 1/2-inch minimum clearance between sleeve and conduit, pipe, duct or covering. Center conduit, pipe or duct in sleeve unless otherwise indicated.
1. Insulation thickness specified for use through sleeves requiring vermin proofing shall be as specified but not less than 1-inch minimum thickness. Refer to Section 230700, “HVAC Insulation.”

F. Install ends of sleeves flush with finished wall surfaces. Cut sleeves to length for mounting flush with both surfaces except, extend floor sleeves for exposed conduits, pipes, and ducts 2-inch above finished floor.

G. Hem edges of duct sleeves extending above floor.

H. Reinforce sleeves temporarily, if necessary, to preserve accurate shape without distortion during construction.

I. Grout sleeves concrete floors, concrete roof slabs and concrete walls into building structure to make joint watertight.

J. Install escutcheon plates for pipes and conduits at floors, ceilings, walls, and partitions in finished areas unless otherwise indicated.

1. Fit escutcheons around insulation, uninsulated pipe, or conduit.
2. Outside diameter shall cover sleeve.
3. Where sleeve extends above finished floor, cover sleeve extension with escutcheon.

L. Pack annular space between sleeve and conduit, pipe, or duct and voids between building construction and conduit, pipe, duct, or sleeves as follows:
1. Firestop equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, for the following sleeve locations:

a. Where vermin control is indicated.
b. Roof and walls with waterproofing.

2. For the following locations, pack annular space between sleeve and conduit, pipe, or duct and voids between building construction and conduit, pipe, or duct sleeves with industrial felt /fire material/ equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, or code approved firestopping foam, caulk, or putty that meets ASTM E-814 with UL classification. Sealants shall not contain toxic or flammable solvents and shall not produce toxic or flammable out-gasing during any stage of application, curing, drying or fire conditions.

a. Floors
b. Smoke barriers
c. Fire rated walls

See Section 23 07 00, “Mechanical Insulation,” for fire stop insulation on pipes and ducts through sleeves.

M. Vermin Control: Provide vermin control for conduits or pipes passing through ceilings, walls, and partitions.

N. Prime surfaces prior to caulking to obtain good adhesion where recommended by sealant manufacturer.

O. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

3.5 IDENTIFICATION

A. Surfaces shall be cleaned and painted if specified, before applying markings.

B. Place markings so that they are visible from the floor.

C. Protect finished identification to ensure that markings are clear and legible when project is turned over to Owner.

D. Ductwork and Piping

1. Apply labels and flow direction arrows on mains and principal branches of piping and ductwork. Wrap the circumference of pipe, overlapping both ends of each marker to give 360-degree identification. Mark each type of service every 25 feet with a minimum of one marking per room and additionally, at each side of penetration of walls, partitions and floors within one foot of penetration.
2. Identify piping with Brady Marker Number as follows:

PIPING SERVICE	TEXT/BACKGROUND COLOR	MARKER NO. FOR PIPES
Condensate Drain	White/Green	7063
Natural Gas	Black/Yellow	7196
Natural Gas Relief	Black/Yellow	Custom
Pumped Condensate Drain	Black/Yellow	7280

PIPING SERVICE	TEXT/BACKGROUND COLOR	MARKER NO. FOR PIPES
Refrigerant Liquid	Black/Yellow	7235
Refrigerant Suction	Black/Yellow	7236

a. Provide Style 4 for pipes 1 to 2-1/2 inches, Style 1 for pipes 3 to 5 inches. For pipes smaller than 1-inch, use same legend and color with Style 3C marker.
b. Provide circumferential tape around both ends of marker to keep it in place.

3. Identify ductwork with Brady Marker labels as follows:

DUCTWORK SERVICE	TEXT/BACKGROUND COLOR	MARKER NO. FOR DUCT
Return Air	White/Green	Custom
Supply Air	White/Green	Custom
Exhaust Air	Black/Yellow	Custom
Outdoor Air Supply	White/Blue	Custom

E. Equipment

1. Identify as to nature, services, system number or other designation with nameplates with letters 1-inch high and colored to contrast with background. Designate which items are main or standby.
2. Equipment requiring identification.

Control Panels
Air Cooled Condensing Units
Air Handling Units
Air Terminal Units
Condensate Pumps
Rooftop Air Handling Units

F. Secure nameplates to devices or adjacent surface.

G. Electrical Items: Identify disconnect switches, starting devices, controls, control switches, pushbutton stations with nameplates. Secure nameplate to device or adjacent surface with screws.

3.6 CONTRACTOR'S INSTALLATION DRAWINGS

A. These drawings shall not be construed as shop drawings that require review and action by the Owner.

B. Submit, prior to installation of mechanical systems, six copies of composite working drawings prepared in coordination with other trades at a scale not less than l/2-inch = 1-foot, clearly showing how work is to be installed in relation to the work of all trades. Contractor shall assist in working out congested space conditions to make a satisfactory adjustment. Drawings shall show the work of all trades (ductwork, conduit, piping, plumbing, lights, equipment, sprinklers, electrical work, etc.) exposed and concealed, /including existing mechanical, plumbing, fire protection, and electrical services, coordinated with each other and with the structure.

Drawings shall be submitted and bear the Owner's review stamp before any materials are ordered or fabricated.

C. Work installed before coordinating with other trades or as to cause any interference with work of other trades shall be changed by the Contractor to correct the conditions at their expense.

D. Drawings shall show existing services where clearances for access are to be maintained.

E. Relocate existing work or modify location of new work as required to maintain required access and code clearances.

3.7 PROJECT RECORD DOCUMENTS

The record set of drawings required o be maintained at the site shall be black and white prints with changes marked in red ink as soon as the changes are made.

3.8 MATERIAL AND EQUIPMENT LIST

A. Submit for Owner's review a list of subcontractors' and manufacturers' names for items proposed for the work within 30 days after award of the contract.

B. Failure to submit list or name manufacturers acceptable to the Owner within time limit will result in the Owner selecting a list of manufacturers, and selection shall be binding upon Contractor.

3.9 SHOP DRAWINGS AND DESCRIPTIVE DATA

A. Submit copies of manufacturer's shop drawings and descriptive data, as required by Division 01.

B. Establish that the physical and functional character of each item including, size, type and required service access is suited for its intended location and use.

C. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.

D. Call attention, in writing, to deviations from contract requirements.

E. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the Owner and the shop drawing has been marked to indicate "No Exception Noted" or "Make Corrections Noted."

F. Specifically identify pertinent project data on the shop drawings.

G. Include Operation and Maintenance Data.

H. Use only final or corrected drawings and data for construction.

I. The Owner's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the

design of adequate connections and details, and the satisfactory construction of all work. All work shall comply to Contract Documents.

3.10 SITE EXAMINATION

Failure to visit site and become familiar with local conditions prior to bidding will not relieve the Contractor of their responsibility for complying with the Contract Documents.

3.11 PERMITS

Obtain and pay for required permits.

3.12 CUTTING AND PATCHING

A. Unless otherwise directed, do cutting and patching. Repair damaged fireproofing and waterproofing to original or better condition.

B. Do not cut walls, floors, reinforced concrete or structural steel without COR's permission. Install services without affecting reinforcing steel.

3.13 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 debris in containers and promptly remove them from the Owner's property.

3.14 WORK IN EXISTING BUILDINGS

A. Conditions of Occupancy

1. This building will be occupied during the life of this contract. Execute work in a manner to impose minimal interference with the normal functioning of the building and its occupants. When interference is unavoidable, schedule work 14 days in advance with the Owner.
2. Make temporary connections where necessary to maintain uninterrupted electrical, plumbing, and heating service.
3. Provide adequate protection for the building, its contents, and occupants.
4. Perform work as quietly as possible to avoid unnecessary disturbance. Unusual precaution may be necessary in the conduct or work in some areas to achieve satisfactory compliance.
5. Coordinate with the Owner to perform sheet metal work, masonry demolition, or other work producing high noise levels, dust, or hazards to occupants during scheduled times.
6. Comply with regulations of the Owner pertaining to circulation, sanitation, and behavior of Contractor's personnel.
7. Refer to Division 01 Section “Work Restrictions” for additional requirements.

B. Temporary Use of Elevator

1. Use only the elevator(s) designated by the Owner for Contractor's use in accordance with the Owner's instructions for use.
2. Protect elevator cab with temporary wood lining on floors, walls, and ceiling throughout period used. Upon completion of construction, restore cab to substantially equal condition as existed prior to Contractor's use. Operate elevator(s) during period complying with regulations governing usage.

C. Field Office, Storage, and Loading Facilities

1. Provide office and storage facilities where designated by the Owner.
2. Provide adequate furnishings including file space, lighting, telephone, and heat where necessary.
3. Use only those toilet facilities designated by the Owner for use by Contractor's personnel.
4. Store equipment and materials in areas designated by The Owner in a manner which will not (a) cause concentrations of weight potentially damaging to building structure, (b) impede normal building traffic, or (c) be a hazard to occupants.
5. Use only the entrance designated by the Owner for delivery and removal of materials. Schedule deliveries and removals with the Owner in advance. Unscheduled traffic must give precedence to Owner's usage. Do not impede access through doorways and corridors with materials, containers, or parked conveyances.
6. Use only rubber wheeled wheelbarrows, dollies, or carts over finished floors.
7. Keep office, storage, and loading areas neat and clean.

D. Temporary Heat

1. Where existing heating is removed or temporarily discontinued, provide temporary heat to protect the building elements, to permit proper conduct of work, and to maintain occupied areas at comfort level.
2. Do not use new heating systems without written permission of the Owner, and if used (a) pay energy costs, (b) do not operate without air filters, and (c) place in as good as new condition including new filters and clean apparatus prior to Owner acceptance. Guarantee period shall not be shortened by such operation.

E. Barricades

1. Erect temporary barriers for protection of occupants, building, and building contents.
2. Where partitions separating occupied areas must be cut, close hole with tight fitting temporary plywood closure panel, 1/2-inch minimum thickness, to form visual and acoustical barrier.
3. Protect exposed holes in floors in accordance with applicable codes and regulations.
4. Enclose dust-producing operations with plastic sheets or drop cloths to prevent the spread of dust into occupied areas. Maintain a negative pressure environment relative to the surrounding spaces.
    a. Take the necessary precautions to prevent the spread of dust and dirt through the existing HVAC system. Protect new and existing return and exhaust air openings.

F. Alterations

1. Cut, alter, remove or temporarily remove and replace existing work necessary for installation of fire suppression, mechanical, and electrical work. Maintain the necessary clearances for accessibility or compliance with code around existing equipment, devices, etc., that are to remain.

2. Verify dimensions of existing building elements pertaining to the installation of new work to assure physical compatibility prior to fabrication or installation.
3. Where the installation of new services or the extension of existing services requires cutting of existing floors, walls, partitions, etc., check for the presence of existing mechanical and electrical services within or immediately beneath construction and exercise necessary precautions to prevent damage to the service or injury to personnel due to contact with same. Where practical, temporarily disconnect such existing service during the cutting operation. Schedule such outages in service with the Owner, 5 days in advance.

G. Furnishings and Equipment: Identify, to the Owner at the time work is scheduled, movable furnishings and equipment which interfere with the progress of the work.

H. Removal of Materials and Equipment

1. Remove promptly from the site, materials and equipment specified to be removed and not reinstalled or stored.
2. Unless otherwise indicated, removal of pipes, ducts, and equipment includes removal of accessories such as hangers, air outlets, piping connections, junction boxes, starters, etc. Remove to source or, if concealed, to point of concealment, connections to mechanical equipment required to be removed or disconnected. Terminate connections behind finished surfaces and, if subject to movement, clear of building construction. Cap connections extending from ducts or piping remaining in service.

I. Roof Protection: The Contractor shall provide full temporary roof protection for the building's existing roof system during all construction which involves construction on the facility roof. Protection shall consist of full area mats, plywood and other protection devices. No construction shall be performed on areas without protection devices in place. No regular traffic directly on the existing roof shall be permitted. Provide roof guard protection pads for all roof top equipment installed under this contract. Pads shall be compatible with the existing roof system. Roof guard pads shall be 3/4-inch thick, textured surface non-skid type. Construction shall be rubber or neoprene materials. Pads shall be minimum 4-by-5 feet units and shall be secured to the existing roof with compatible adhesives. Pad surface shall be heavy duty, damage resistant. Provide a minimum of 300 square feet of pad for each piece of roof top equipment. Install pads immediately adjacent to equipment; at all regular maintenance locations; and probable walkways to the equipment. Install and secure in accordance with the manufacturer's instructions.

J. Cleaning Ductwork: Vacuum clean internally existing ductwork within renovated area.

K. Connections to Existing Systems

1. Connect to existing systems as indicated.
2. Obtain permission from Owner 5 days in advance if outage of service is necessary to make connections. See the Article titled, "Outages."
3. Repair insulation damaged at points of connection. Restore integrity of vapor barriers and surface finish.

3.15 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. Do not use rags, wool, cotton, paper, waste or similar materials for plugging.

C. Existing components of the building and its systems shall be protected from damage. Any damage to these components shall be repaired or replaced to the satisfaction of the Owner. Special care shall be taken with regards to insulation on existing piping and ductwork. Damaged insulation shall be replaced so that the vapor barrier and insulating characteristics of the material match those prior to damage taking place.

3.16 CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior are free of foreign matter.

B. Leave strainers and dirt pockets in clean condition.

C. Clean ductwork, registers, grilles, and diffusers at completion of work.

D. Install air filters of equal efficiency to those specified in permanent air systems operated for temporary heating or air balancing during construction. Replace with clean filters as specified prior to acceptance and after cleaning of system.

1. Replace existing filters in existing systems serving the renovated areas at the discretion of the Owner that may have become loaded due to renovation work.

E. Pay for labor and materials required to locate and remove obstructions from systems clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

F. Leave systems clean, and in complete running order.

3.17 ASBESTOS

Should material resembling asbestos-containing materials be encountered during execution of work, immediately notify the Owner for instructions before proceeding.

3.18 EQUIPMENT SUPPORTS

A. Provide equipment supports consisting of structural members, hangers, rods, and incidental materials.

B. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas.

C. Concrete Equipment Pads

1. Provide concrete pads not less than 4 inches high and projecting not less than 3 inches on all sides beyond equipment for floor mounted equipment.
2. Place anchor bolts in steel pipe sleeves, with a plate at bottom end of sleeve to hold bolts.

3. Grout between base plate and foundation.

3.19 OPERATING AND MAINTENANCE MANUAL

A. Furnish manual bound and indexed containing:

1. Brief description of each system and components.
2. Starting and stopping procedures.
3. Day/night changeover.
4. Seasonal changeover
5. Special operating instructions.
6. Routine maintenance procedures.
7. Schedule for periodic servicing and lubrication.
8. Manufacturers' printed operating and maintenance instructions, parts lists, illustrations and diagrams.
9. One final or corrected reviewed copy of each shop drawing and Contractor's drawings.
10. One copy of each wiring and piping diagram.
11. One reviewed copy of certified test reports.
12. Air balancing report.
13. Product warranty information.

B. Submit to the Owner for review at least 30 days prior to date it is expected system will be turned over to Owner.

C. After review by Owner, submit three copies to Owner and one to Engineer of Record.

3.20 FIELD INSTRUCTION

A. Upon completion of work, instruct Owner’s representatives in the proper operation and maintenance of the mechanical and electrical systems.

B. Instruction periods specified below shall be in addition to instructions 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 (1) one- eight-hour day.

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 COR.

E. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Commissioning Authority. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in cooperation with the Commissioning Authority after submission and approval of formal training plans. Refer to Division 1 Section 01 70 00, “Execution and Closeout”, for contractor training requirements.

3.18 OUTAGES

A. The purpose of this article is to establish standard procedures for requesting an outage for mechanical, electrical, or operational systems or services associated with the building systems and physical plant.

B. An outage is defined as prohibiting or restricting a mechanical, electrical or operational service from routine operation (see attached outage request for service included). For purposes of repair, replacement or connection to an existing system, this standard shall be followed.

C. All persons requesting an outage shall complete an "Outage Request Form" included at the end of this Section.

D. Contractor shall submit, in writing with the "Outage Request Forms" a plan on the work to be performed during the outage, including length of time and reason the utility system must be shutdown. Contractor, in conjunction with the Owner, shall research and identify all systems affected by Outage as well as locating and listing all components by tag or facility equipment number, and all the action required at each to achieve the outage. Submit written Plan and Outage Form 5 days in advance of requested outage to Owner.

E. Submit written Plan and Outage Form 14 days in advance of requested outage to the Owner's O&M contractor. Refer to Contract Documents for contact information.

F. All "Outage Request Forms" and the Outage Plan shall be reviewed by the construction foreman or superintendent for feasibility and necessity.

G. All "Outage Request Forms" and the Outage Plan shall be forwarded to the "Plant Operations and Maintenance Manager" for review and approval prior to scheduling. Contractor shall attend weekly Outage Review Meetings and be prepared to answer questions and discuss the plan.

H. After approval by the Plant Operations and Maintenance Manager, the outage shall be scheduled by either the Buildings or Utilities Superintendent (according to the services requested for outage). Owner's representative will notify the Contractor, in writing, to proceed. No outage shall proceed prior to written notification from the Owner's representative.

I. All systems, when shutdown, shall be tagged in accordance with OSHA building tag-out procedures.

J. The number and duration of all outages shall be minimized.

K. A master outage list, with the approximate required dates, shall be submitted to the Owner within 14 days from the commencement of work.

Attachments: Outage Request Form

END OF SECTION 23 05 00

OUTAGE REQUEST FORM

DATE: _____

OUTAGE REQUESTED BY: _____

DEPARTMENT/COMPANY NAME: _____

PURPOSE OF OUTAGE: _____

DATE NEEDED: _____

BUILDING AFFECTED: _____

AREA WITHIN BUILDING TO BE AFFECTED: _____

THE FOLLOWING SERVICES ARE REQUESTED TO BE REMOVED FROM SERVICE:

_____ HOURS

a. ___ FIRE PROTECTION ___ SPRINKLER
___ HOSE CABINET/STANDPIPE SYSTEM
b. ___ COLD WATER (DOMESTIC)
c. ___ SANITARY SEWER
d. ___ HOT WATER (DOMESTIC)
e. ___ CHILLED WATER
f. ___ HEATING WATER
g. ___ AIR HANDLING SYSTEMS
h. ___ ELEVATOR
i. ___ NORMAL ELECTRIC POWER ___ LIGHTING
___ POWER
j. ___ EMERGENCY ELECTRIC POWER
k. ___ ASBESTOS REMOVAL
l. ___ NATURAL GAS

SECTION 23 05 48 - MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

Vibration isolation devices, accessories, and supports to prevent transmission of vibration from mechanical equipment and distribution systems to building structure.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 – Basic Mechanical Materials and Methods

C. Section 23 20 00 – Building Services Piping

D. Section 23 70 20 – Packaged Rooftop Units

E. Section 23 81 26 – Split-System Air Conditioners

1.3 QUALITY ASSURANCE

A. The vibration isolator manufacturer's representative shall determine spring sizes and mountings, and shall provide field supervision and inspection to ensure proper installation, adjustment and performance. The representative shall notify the Engineer of any isolator selections, which may experience resonance with the approved equipment, and upgrade any isolators that are found to resonate with the installed and operating supported equipment.

B. Wind Load Restraint Device Load Ratings: Devices shall be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices shall be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public.

C. Vibration isolation mounts, hangers and equipment bases for Division 23 work shall be from the product line of a single manufacturer or products represented by the same manufacturer's representative.

D. Work shall be performed by skilled workers who are experienced in the necessary workmanship to meet the requirements of this Section.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, "Basic Mechanical Materials and Methods".

B. Vibration Isolation Product Data:

1. Manufacturer's technical project data for each type of vibration isolation, including installation instructions, accessories, supports, bases, fittings, finishes, construction details and dimensions of components.
2. System application for each type of vibration isolation.

C. Delegated Design Submittal

1. For each wind load protection device, including /pipe riser resilient support, concrete anchor and insert, and restrained isolation roof-curb rail that is required by this Section or is indicated on Drawings, submit the following:

    a. Wind Load/ Restraint and Vibration Isolation Base Selection: Select vibration isolators, wind load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.

    b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.

    c. Concrete Anchors and Inserts: Include calculations showing anticipated wind loads.

    d. Wind-Load Design Calculations: Submit all static and dynamic loading calculations.

    e. Qualified Professional Engineer: All designated-design submittals for wind restraint calculations shall be signed and sealed by qualified professional engineer responsible for their preparation.

2. Wind Restraint Detail Drawing:

    a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.

    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Indicate association with vibration isolation devices.

    c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

3. All delegated design submittals for wind restraint detail drawings shall be signed and sealed by qualified professional engineer responsible for their preparation.

4. Product Listing, Preapproval, and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).

5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.

6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

D. Operation and Maintenance Data

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Schedule of Equipment Isolation is included in this Section.

B. Wind-Restraint Loading

1. Three-second Wind Gust Speed: 120 mph.
2. Building Risk Category: II.
3. Exposure Category: B.
4. Minimum 10 lb/sq. ft. multiplied by maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATION DEVICES

A. Select isolators for uniform static deflections according to distribution of weight and to meet requirements shown elsewhere in the Contract Documents.

B. Select isolators for not less than the deflections indicated on the Schedule.

C. Select vibration isolation for stable operation during starting and stopping of equipment without excessive movement of equipment.

D. Bases: Provide rectangular bases, unless indicated otherwise.

E. Corrosion Resistance: All springs and associated metal hardware shall be designed or treated for resistance to corrosion. Steel components shall be PVC coated, or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc electroplated. Structural steel bases and exposed steel components of concrete inertia bases shall be cleaned of welding slag and primed with zinc-chromate or metal etching primer. A finish coat of industrial grade enamel shall be applied over the primer.

F. Outdoor Locations: Steel parts PVC coated, hot-dip galvanized, zinc-electroplated plus coating of neoprene, bitumastic paint, or powdered coating. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts, and washers may be zinc-electroplated.

2.2 MOUNTINGS

A. Type D1: Double layer neoprene cross-ribbed or waffle pattern, each layer 5/16-inch thick. Maximum hardness shall be 40 durometers. Imprint durometer on material. Size for deflection of 10-20 percent of unloaded pad height. Hot dipped galvanized steel bearing plates where necessary to spread loads. Mason Industries Type W or Super W.

B. Type D2: Same as Type D except with a cemented steel plate on top with a 3/4-inch diameter center hole for bolting through. Include a 3/4-inch Neoprene isolation washer cemented to a steel washer as well. Mason Industries Type MBSW and Type HLW.

C. Type E: Closed cell neoprene strip, 4 inches wide, 3/4-inch high.

2.3 HANGERS

A. Type J: Thrust restraints shall be in sets of two or more, and shall be springs in series with neoprene. Deflection shall be equal to deflection of isolators supporting the unit being restrained. Provide thrust restraints complete with rods and adjustment nuts, plus angle brackets and backing plates for attachment to the unit being restrained and anchor supports. Mason Industries Type WB series.

2.4 BASES

Type P: Curb mounted rooftop equipment isolation bases constructed to fit the top of standard curbs and match the underside of the isolated equipment. Aluminum construction welded in the corners to provide weather tightness. Flexible neoprene connection weather seal. Cadmium plated steel springs. Spring stability shall provide horizontal wind resistance. Install assembly with rubber blocks located in each corner between the two frames. Mason Industries CMAB.

2.5 HOSES

A. Type S

1. Metallic, flexible bellows type bronze hose with bronze braid or Type 321 stainless steel hose with stainless steel braid. Bronze for application with copper tubing and brass piping; stainless steel for ferrous applications. Hose shall have weld, thread, flange or sweat connections as required for piping or tubing connection application.
2. Hose length shall be a minimum length of 9 inches.
3. For freon refrigeration service, hose shall have adequate pressure rating for compressor discharge service working pressure of 300 psig at 250 degrees F; suction service working pressure of 200 psig at 100 degrees F.
4. Mason Industries/Mercer Rubber Type BBS stainless, CPS bronze.

2.6 ELASTOMERIC GROMMETS

Type U: Grommets shall be a separate bushing with a separate washer or combination neoprene washer/bushing. Grommets shall be formed to prevent bolts from directly contacting the secured item. Elastomer shall be 56 durometers maximum. Mason Industries Type HLB bushing with HLW washer or HG washer/bushing.

2.7 ACOUSTICAL SEALANT

Sealant for acoustical purposes, as described in this Section, shall be silicone or one of the non-setting sealants listed under the Article titled “Manufacturers” in Part 2 of this Section.

2.8 RESILIENT PENETRATION SLEEVE/SEAL

A. Field fabricate from pipe or sheet metal section 1/2 to 3/4-inch larger in each dimension than penetrating element in all direction around the element. Use to provide a sleeve through the construction penetrated. Extend sleeve 1-inch beyond the penetrated construction on each side. Pack annular space between sleeve and the penetrating element tightly with glass fiber or mineral wool to within 1/4-inch of ends of sleeve. Fill remaining 1/4-inch space on each side with acoustical sealant to form an airtight seal. Penetrating element shall be able to pass through sleeve without contacting sleeve. Alternatively, prefabricated sleeves accomplishing same result are acceptable. Mason Industries Type SWS

B. Do not use at fire-rated penetrations.

2.9 MANUFACTURERS

A. Mountings, Bases, Hangers, Resilient Sleeves: Amber-Booth, Kinetics Noise Control, Inc., Korfund, Mason Industries, Vibration Eliminator, Vibration Mountings and Controls, Vibrex.

B. Hoses: Amber-Booth, General Rubber, Mason-Mercer Rubber, Metroflex.

C. Grommets: EAR Specialty Composites Corp., Gates Molded Products, Mason Industries, Tech Products Corp., Vibration Mountings and Controls, Vibrex.

D. Acoustical Sealants: DAP, Pecora, Tremco, USG.

PART 3 – EXECUTION

3.1 VIBRATION ISOLATION DEVICES

A. Install in accordance with manufacturer’s recommendations. Corrosion coatings damaged during installation shall be repaired.

B. Install isolators in locations to permit inspection and adjustment, and to provide proper operation. Maintain 2-inch clearance between isolated equipment and walls, ceilings and other equipment. Isolated systems shall be independently supported.

C. Adjust leveling bolts so that isolated equipment is level and in proper alignment with connecting ducts and pipes. All vibration isolators shall be aligned squarely above or below mounting points of supported equipment.

D. Provide structural base plate under isolator where isolator is wider than supporting structural member. Tack weld plate to structural member.

E. Where necessary, provide lateral snubber or Type J thrust restraint isolation, which will not interfere with main isolator performance, to prevent movement in excess of 1/4-inch due to dynamic forces.

F. Mount equipment on steel base of adequate structural rigidity when equipment or frame is not structurally suitable for the type of isolation specified. Spring and rail and spring supports are specified on the basis that the equipment is structurally built or supported on a rigid frame. Isolators for equipment with bases shall be located on sides of the base, which are parallel to the equipment shaft.

G. Install Type E strips under air handling unit perimeter base and between Type D1 pad isolation without any gaps between pads and strips so as to prevent placement of any materials under the air handling unit that prevents function of Type D1 pad.

3.2 EQUIPMENT ISOLATION SCHEDULE

A. If the mount baseplate is bolted to structure or framework rigidly connected to the structure, Type U elastomeric grommets shall be used between each bolt and the baseplate to prevent rigid connection. These additional neoprene washers and bushings may be omitted if the baseplate and friction pad incorporate neoprene elements that eliminate rigid contact between bolts and the baseplate. Bolt holes shall be properly sized to allow for bushing sleeve. The anchor bolt shall incorporate steel washers to distribute load evenly over neoprene washers.

B. Isolation Schedule

TYPE OF EQUIPMENT	**SUPPORTING STRUCTURE**			
	FLOOR SLAB ON EARTH		**OTHER FLOOR AND ROOF**	
	ISOLATION BASE TYPE	**MIN. STATIC DEFLECTION IN INCHES**	**ISOLATION BASE TYPE**	**MIN. STATIC DEFLECTION IN INCHES**
Air Handling Units				
RTU-3	-	-	D1+E	0.10
AHU-4	-	-	D1+E	0.10
Air-Cooled Condensing Units	-	-	D2	0.10

3.3 PIPING ISOLATION

A. Type S Hoses: Provide on refrigerant piping connected to air handling units and condensing units.

B. The installation of vibration isolators shall not cause any change of position of piping, that will result in stresses in piping connections or misalignment of shafts or bearings. Account for changes in height and weight when pipes are filled with water.

C. Resilient Penetration Sleeve/Seals: Provide penetration seals to maintain an airtight seal around penetrating elements and to prevent rigid contact of penetrating element and building construction. Fit sleeve tightly to building construction and seal airtight on both sides of construction penetrated with acoustic sealant.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

END OF SECTION 23 05 48

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Preparation, testing, adjusting, and balancing of mechanical equipment and air distribution systems including inspection and certification reports.

1.2 RELATED DIVISIONS

A. Division 01 - General Requirements

B. Division 23 - Heating, Ventilating, and Air Conditioning

C. Division 26 – Electrical

D. Division 28 - Electronic Safety and Security

1.3 QUALITY ASSURANCE

A. Agency shall be a member of the Associated Air Balance Council or the National Environmental Balancing Bureau.

B. Perform work in accordance with AABC or NEBB National Standards.

C. Certify that measurement instruments have been calibrated within 12 months prior to use on this project.

D. Agency shall directly oversee work performed by it employing a competent supervisor subject to the approval of the Owner.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 230500, “Basic Mechanical Materials and Methods”.

B. Qualifications of Personnel

C. List of Instrumentation and Instrumentation Certification Report

D. Proposed Work Schedule Outline

E. Equipment Installation Inspection Report(s)

F. Testing, Adjusting and Balancing Report

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Obtain applicable contract documents and copies of submittals for equipment and automatic control systems.

B. After cleaning, prepare systems for proper operation. Systems shall be completely installed and in continuous operation before testing, adjusting and balancing (TAB) work is performed.

PART 2 - PRODUCTS

2.1 DUCTWORK TEST HOLE PLUGS

Removable self-sealing plastic

2.2 INSULATION REPAIR

Match original material type, vapor barrier jacket and thickness.

PART 3 - EXECUTION

3.1 DUCTWORK TEST HOLE PLUGS

Install plugs in ductwork after drilling test holes.

3.2 INSULATION REPAIR

Repair insulation removed or damaged for TAB work.

3.3 INDEPENDENT TAB AGENCY

A. Procure the services of an independent balancing and testing agency, not associated with the Mechanical Contractor, to perform the testing, adjustment and balancing (TAB) of equipment and air flows including air outlets in the heating, ventilating and air conditioning systems. Report instances in which the specified quantities cannot be provided by the installed equipment so that corrections to the equipment can be made under the section wherein it was specified. Check

operation of air terminal unit electric heaters and their temperature control through full range of capacity.

B. Add dampers required for correct balance as recommended by the agency at no additional cost to Owner. Submit such additions for Engineer's review.

3.4 TAB INSTRUMENTS

Calibrate instruments used for testing and balancing of air and hydronic systems within a period of 12 months prior to TAB. Submit final test analysis reports, including a letter of certification listing instrumentation used and last date of calibration.

3.5 PRE-DEMOLITION REPORTS

Contractor shall perform pre-demolition airflow readings for all diffusers within project space prior to any demolition. Contractor shall set building airflow serving space to full cooling prior to taking airflow readings. Provide report to the Owner and Engineer of Record within 5 days of taking airflow measurements.

3.6 TAB REPORTS

A. Inspection reports covering equipment and systems installation shall be submitted during early stage of the project in order to allow timely correction of deficiencies.

B. Follow check list format developed by AABC or NEBB, supplemented by narrative comments. Check for conformance with submittals. Verify that diffusers and grille sizes are correct. Check air terminal unit installation including /insulated/ flexible duct sizes and routing.

C. TAB reports covering flow balance, adjustments, and performance tests, working copy of reports shall be submitted as soon as TAB is performed for any necessary system evaluation.

D. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

E. Submit three copies of complete test reports for review.

3.7 TAB PHASING

A. Coordinate TAB procedures with phase construction completion requirements for the project. Systems serving completed phases of the project will require TAB for such phases prior to partial acceptance and for final acceptance.

B. Allow sufficient time in construction schedule for TAB and submission of reports prior to partial acceptance and for final acceptance.

3.8 EQUIPMENT INSTALLATION INSPECTION

An evaluation report shall be completed after air distribution equipment is on site and duct installation has begun, but in advance of performance testing and balancing work. Identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

3.9 TAB REQUIREMENTS

A. Provide TAB for equipment and motors including performance tests as required in applicable sections of Division 23.

B. During final TAB, related systems shall be in full operation.

C. Test and balance systems in all specified modes of operation, including variable volume. Verify that dampers and other controls function properly.

D. Operate fans at slowest speed that will deliver indicated air quantity.

E. Compensate for condition of air filters at time of balancing so that system will deliver proper amount of air when filters become dirt-laden and nearly due for replacement.

F. Record positions of outdoor, return, and relief dampers as set for cooling cycle.

G. Air Terminal Units: Check and adjust air terminal units for maximum and minimum flow values to obtain required air flows.

H. Adjust duct volume dampers to minimize outlet and inlet damper throttling.

I. Install sectorizing baffles in diffusers to overcome drafts caused by flow interference of obstructions.

J. Operating Tests: Demonstrate to the Owner the specified performance of systems and components.

3.10 COORDINATION WITH THE AUTOMATIC CONTROL SUBCONTRACTOR

A. The Automatic Control System (ACS) Subcontractor shall put the system in the required mode of operation as requested by the Testing and Balancing (TAB) Subcontractor. All programming changes and reporting of data from the Building Automation System (BAS) needed to achieve proper performance shall be done by the ACS Subcontractor. The TAB Subcontractor shall be the lead Subcontractor in coordinating his work and the ACS Subcontractor's work. All work is by the TAB Subcontractor unless noted as being the responsibility of the ACS Subcontractor.

B. Single Duct Terminal Unit Flow:

1. Accuracy of the terminal unit flow readings as read by the ACS Subcontractor from the DDC system shall be certified through measurements by the TAB Subcontractor.

2. The ACS Subcontractor shall place the terminal unit in a "Test" mode which will cause all terminal units to control to design maximum flow.

3. The TAB Subcontractor shall request the system be placed in the "Test" mode by the ACS Subcontractor one time, and then be responsible to record the flows at maximum

and minimum flow settings for all units. The TAB Subcontractor shall select the minimum flow settings as required.

4. Report any deviations in excess of plus or minus 10 percent to the Engineer as soon as possible so corrective action by the Mechanical or ACS Subcontractors can be performed. These problem areas may require remeasuring by the TAB Subcontractor.

5. The ACS Subcontractor shall, after receipt of all terminal unit data, change any programming necessary to correct the flows to the values measured by the TAB Subcontractor.

6. The supply and static pressure control setpoint shall be rechecked by the ACS Subcontractor to ensure that the static pressure setpoint is the lowest value which enables all terminal units to deliver the design maximum flow, plus or minus 10 percent, with the variable speed drive at maximum speed. The TAB Subcontractor shall make any fan adjustments needed.

END OF SECTION 230593

SECTION 23 07 00 - MECHANICAL INSULATION

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

Insulation for piping and ductwork specified in Division 23.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 20 00 - Building Services Piping

D. Section 23 31 13 - Ductwork

E. Section 23 33 00 - Air Duct Accessories

1.3 QUALITY ASSURANCE

A. Unless otherwise noted, pipe insulation shall have a K value insulation conductivity Btu inch/hour-ft^2 degrees F in accordance with the 2015 International Energy Conservation Code (IECC).

B. Unless otherwise noted, duct insulation shall have an insulation R-value (hour)(ft^2) (degrees F)/Btu in accordance with 2015 IECC.

C. Duct insulation materials are restricted to those which are UL listed in accordance with the requirements of NFPA 90A, latest edition, and with a flame spread index not over 25 and a smoke developed index no higher than 50.

D. Insulation on pipes and ducts through floors, fire rated walls, and smoke barriers shall be UL listed fire-stop insulation to maintain fire resistance of the floor, fire rated wall, or smoke barrier in accordance with NFPA 101.

E. Field applied canvas, woven glass fiber reinforcing mesh, woven polyester mesh, and woven glass fiber cloth covering shall be flame and mildew proof.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Each type of insulation: Manufacturer and product designation, surface burning characteristics, thickness, density in pounds in accordance with cubic foot, thermal conductivity or R-value, water permeance thickness, jackets (factory and field applied), and accessories.

C. System application for each type of insulation.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail application at linkages of control devices.

E. Statement of compliance with 2015 IECC.

F. Statement of compliance with NFPA 90A, flame spread index and smoke developed index requirements.

G. Statement of compliance with National Architectural and Industrial Maintenance Rule for VOC levels on Adhesives, Mastics, and Coatings for the State of Maryland.

H. Statement of compliance with Ozone Transport Commission for VOC levels on Adhesives, Mastics, and Coatings for the State of Maryland.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Where insulation must be stored outdoors, provide polyethylene film cover for protection. Insulation that becomes wet shall be replaced; drying of insulation is not acceptable.

B. Coordinate sizes and locations of supports, hangers and insulation shields specified in other sections of the specifications.

C. Coordinate clearance requirements for installation of insulation and field applied jackets and finishes for pipe, ductwork, and equipment installation and space for maintenance.

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL REQUIREMENTS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products shall comply with the National Architectural and Industrial Maintenance (AIM) Rule for VOC levels for the State of Maryland.

C. Products shall comply with the Ozone Transport Commission limits for VOC levels for the State of Maryland.

2.2 ADHESIVES, MASTICS, COATINGS

A. Adhesives

1. Type A1

a. High tack, rapid setting water-based adhesive.
b. Solvent free, low VOC (0.03 pounds/gallon) synthetic elastomer emulsion.
c. Non-flammable when wet and fire-resistive when dry.
d. Moisture resistant.
e. Flame spread index 0 and smoke developed index 0.
f. Asbestos, lead, and mercury free.
g. ASTM C916 Type 11.

B. Mastics

1. Type M1

a. White, flexible, water-based vapor barrier mastic.
b. Low VOC (0.3 pounds/gallon).
c. Non-flammable when wet and fire-resistive when dry.
d. Water resistant and low water vapor permeance.
e. Flame spread index 5 and smoke developed index 25.
f. Asbestos, lead, and mercury free.

2. Type M3

a. White, flexible, elastomeric coating.
b. Vapor barrier for outdoor application, chemical resistant, and UV and sunlight resistance.
c. Fire resistant.
d. Flame spread index 10 and smoke developed index 15.
e. Asbestos, lead, and mercury free.

C. Coatings

1. Type C1

a. White, washable, abrasion-resistant coating.
b. Low VOC (0.13 pounds/gallon).
c. Fire resistant.
d. Flame spread index 10 and smoke developed index 5.
e. Asbestos, lead, and mercury free.

D. Manufacturers: Childers, Foster, Mon-Eco Industries.

2.3 INSULATION TYPES

A. Type A

1. Insulation: Pre-formed, sectional molded glass fiber pipe insulation bonded with a thermosetting resin meeting ASTM C547 Standard Specifications for Mineral Fiber Pipe Insulation, Type I, Grade A.
2. Minimum Density: 3.0 pounds per cubic foot.
3. Factory Applied Jacket: White, polypropylene-coated ASJ jacket with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
4. Factory-fabricated shapes in accordance with ASTM C450 and ASTM C585.
5. Insulated Fitting Covers: Insulation insert with PVC cover equivalent to Zeston.
6. Insulation Materials shall be listed and labeled per UL723 in plenum spaces, as required by code.
7. Operating Temperatures: 0 to 850 degrees F.
8. Maximum Moisture Vapor Transmission: 0.01 perms.
9. Manufacturers: Johns-Manville Micro-Lok HP Ultra, Knauf Earthwool 1000º Pipe Insulation, Owens-Corning Fiberglass Insulation SSLII with ASJ Max.

B. Type C

1. Insulation: Flexible, closed-cell elastomeric pipe insulation equal to AP Armaflex, AP Armaflex SS or ArmaFlex Ultra (for plenum applications), meeting ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, Type I.
2. Minimum Density – 3 to 5 pounds in accordance with cubic foot.
3. Material shall have a flame spread index of 25 or less and a smoke developed index of 50 or less as tested by ASTM E84.
4. Insulation Materials shall be listed and labeled per UL723 in plenum spaces, as required by code.
5. Operating Temperatures: 0 to 220 degrees F.
6. Maximum moisture vapor transmission: 0.08 perms.
7. Manufacturers: Aeroflex, Armacell, K-flex.

C. Type E

1. Insulation: Flexible glass fiber blanket bonded with a thermosetting resin meeting ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.
2. Minimum Density: 3/4-pound per cubic foot.
3. Factory Applied Jacket: FRK/FSK facing, vapor retardant barrier jacket of minimum 0.001-inch aluminum foil, fiberglass reinforced scrim with kraft paper backing, complying with ASTM C1136, Type II.
4. Operating Temperatures:

    a. Glass Fiber: Up to 250 degrees F.

5. Maximum Moisture Vapor Transmission: 0.02 perms.
6. Manufacturers: Certain-Teed, Johns-Manville Microlite EQ FSK Duct Wrap, Knauf Atmosphere Duct Wrap, Owens-Corning SoftR Duct Wrap FRK.

D. Type F

1. Insulation: Semi-rigid, glass fiberboard bonded with a thermosetting resin meeting ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks, Type II or IIIA, Category 2.
2. Minimum Density: 2.5 pounds per cubic foot.

    a. Up to and Including 22-inch Diameter: Sectional molded type.
    b. Twenty-four-inch Diameter and Above: Sectional molded type or rigid board accurately beveled or scored.

3. Factory Applied Jacket: White, polypropylene coated ASJ jacket, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
4. Operating Temperatures: 35 to 850 degrees F.
5. Maximum Moisture Vapor Transmission: 0.02 perms.
6. Manufacturers: Certain-Teed CrimpWrap Pipe & Tank, Johns-Manville Micro-Flex, Knauf KwikFlex, Owens-Corning Flex Wrap ASJ.

E. Type G

1. Insulation: Rigid glass fiberboard bonded with a thermosetting resin meeting ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation, Type 1A or 1B.
2. Minimum Density: 6 pounds per cubic foot.
3. Factory Applied Jacket: White, polypropylene-coated ASJ jacket, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
4. Operating Temperatures: 35 to 250 degrees F.
5. Maximum Moisture Vapor Transmission: 0.02 perms.
6. Corner Angles: PVC, Aluminum, or Stainless Steel suitable for the application.
7. Manufacturers: Certain-Teed Commercial Board, Johns-Manville 800 Series Spin-Glas, Knauf Earthwool Insulation Board, Owens-Corning 700 Series Board Insulation.

F. Type H

1. Insulation: Rigid glass fiberboard bonded with a thermosetting resin meeting ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation, Type IA or IB.
2. Minimum Density: 6 pounds per cubic foot.
3. Factory Applied Jacket: White, polypropylene-coated ASJ jacket, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
4. Operating Temperatures: 35 to 250degrees F.
5. Maximum Moisture Vapor Transmission: 0.02 perms.
6. Corner Angles: PVC, Aluminum, or Stainless Steel suitable for the application.
7. Manufacturers: Certain-Teed CertaPro Commercial Board, Johns-Manville 800 Series Spin-Glas, Knauf Earthwool Insulation Board, Owens-Corning 700 Series Board Fiberglass Insulation.

G. Type O

1. Insulation: Flexible, closed-cell elastomeric sheet insulation laminated with white thermoplastic rubber (TPR) membrane, equal to ArmaTuff or ArmaTuff SA meeting ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, Type II.
2. Maximum Moisture Vapor Transmission: 0.02 perms.
3. Material shall have a flame spread index of 25 or less and a smoke developed index of 50 or less as tested by ASTM E84.
4. Operating Temperatures: Minus 70 to 220 degrees F.
5. Provide ArmaTuff Tape for protection of seams and exposed edges.
6. Manufacturers: Aeroflex, Armacell, K-flex.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
   1. Width: 3 inches.
   2. Thickness: 10.8 mils.
   3. Adhesion: 45 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
   7. Manufacturers: Ideal Tape Co., Johns-Manville, Knauf, Owens-Corning, 3M, Venture Tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 45 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
   7. Manufacturers: Ideal Tape Co.,Knauf, Owens-Corning, 3M, Venture Tape.

PART 3 - EXECUTION

3.1 GENERAL PREPARATION AND APPLICATION REQUIREMENTS

A. Complete piping, ductwork, and equipment tests before insulation is applied.

B. Clean and dry surfaces to be insulated of loose scale, dirt, oil, water and other foreign matter that will adversely affect insulation application.

C. Insulate completely metal surfaces of piping and ductwork other than hangers as delineated under Extent of Insulation.

D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

F. Install insulation with least number of joints practical.

G. Permit expansion and contraction without causing damage to insulation or surface finish.

H. Extend surface finish to protect surfaces, ends, and raw edges of insulation.

I. Fire-stop insulation shall be continuous to 6 inches on either side of barrier. Seal jacket seam and end joints to adjacent sections of insulation for continuous vapor barrier. Annular space between insulation and sleeve shall be sealed as specified in Section 230500, “Basic Mechanical Materials and Methods,” in the Article titled, "Sleeves and Escutcheon Plates."

J. Provide vapor retarding barriers continuous and uninterrupted throughout the system where specified.

K. Where connections are made to existing systems, provide insulation as specified and to match existing where existing insulation is removed or damaged for new connection. Provide vapor barrier continuously sealed to the existing insulation.

L. Mix insulating cements with clean potable water.

M. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

N. Install insulation with longitudinal seams at top and bottom of horizontal runs.

O. Install multiple layers of insulation with longitudinal and end seams staggered.

P. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Q. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that become wet.

R. Cut insulation in a manner to avoid compressing insulation.

S. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

T. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

U. Penetrations

1. Roof and Aboveground Exterior Wall Penetrations: Install insulation continuously through penetrations.

    a. Seal penetrations with flashing sealant.

b. For applications requiring only indoor insulation, terminate insulation above roof surface for roof penetrations and at inside wall surface for wall penetrations. Seal with joint sealant.
c. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
d. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing for roof penetrations, and wall flashing for wall penetrations and overlap wall flashing at least 2 inches.
e. Seal jacket to roof flashing with flashing sealant.

2. Non-Fire Rated Interior Floor, Wall and Partition Penetrations: Install insulation continuously through floors, walls and partitions.
3. Fire-Rated Floor, Wall and Partition Penetrations:

a. Terminate insulation at fire damper sleeves and externally insulate damper sleeves to match adjacent insulation. Overlap duct insulation at least 2 inches.
b. Pipe: Install insulation continuously through floor penetrations.
c. Seal penetrations through fire-rated assemblies according to Division 07.

V. Piping

1. Insulate fittings including unions. For the purpose of this specification, fittings include unions and flanges. Install insulation with continuous thermal and vapor retardant integrity, unless otherwise noted. Use premolded material where available.
2. Fill hollow interior of protection saddles with insulating cement.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

W. Ductwork

1. Use of materials is restricted for duct insulation to those which are UL listed in accordance with the requirements of NFPA 90A, latest edition, and with a fire hazard rating as tested in accordance with ASTM E84 and UL 723 not to exceed 25 flame spread index and smoke developed index not to exceed 50.
2. Insulation Materials shall be listed and labeled per UL723 in plenum spaces, as required by code.
3. Cover standing seams and metal surfaces with insulation.
4. Provide staples that are stainless steel, outward clinching, and sealed to maintain vapor barrier.
5. Unless otherwise indicated, insulation is not required on flexible connectors and factory insulated flexible ducts.

X. Vermin Proofing: Wherever insulated piping and ductwork pass through sleeves or openings which are required to be vermin proof, provide sections of foamed glass insulation equal in length to length of sleeves. Refer to Section 230500, “Basic Mechanical Materials and Methods,” in the Article titled, “Sleeves and Escutcheon Plates” for details and extent of vermin proofing.

3.2 ADHESIVES, MASTICS, COATINGS

A. Apply adhesives, mastics and coatings at the rate of coverage and in a manner recommended by the manufacturer.

B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise noted.

3.3 INSULATION TYPES

A. Type A

1. Application

a. Pipe: Fit insulation to pipe, staggering longitudinal joints. Seal longitudinal joint overlaps with 4-inch wide sealing strips of vapor barrier jacket material applied on circumferential joints with Type A1 adhesive. Seal end joints and protrusions with Type A1 adhesive. Seal with a 1/16-inch thick coat of Type M1 mastic for cold lines. Imbed a layer of glass fiber fitting tape in the mastic and after the initial coat has dried, apply an additional 1/16-inch coat of mastic.

b. Fittings, Valves, and Pipe Specialties: Apply fabricated or premolded insulated fitting covers or insulating cement equal in thickness and density to adjoining pipe insulation. Seal with a 1/16-inch thick coat of Type M1 mastic for cold lines. Imbed a layer of glass fiber fitting tape in the mastic and after the initial coat has dried, apply an additional 1/16-inch coat of mastic.

1) Fill voids with mineral fiber blanket insulation.
2) Arrange insulation on valves to permit access to packing and to allow valve operation without disturbing insulation

2. Surface Finish

a. All piping.

1. Pipe

a) Standard duty, concealed and exposed – no additional finish required.
b) Heavy Duty – Apply a tack coat of Type C1 coating over entire surface; imbed a layer of 8-ounce canvas; when dry, apply a second coat of Type C1 coating Fittings and Valves:
a) Standard Duty – no additional finish required.
b) Heavy Duty – Apply a finish coat of Type C1 coating after mastic has thoroughly dried.

2. Apply heavy-duty surface finish to pipes, fittings, and valves when not concealed within a shaft or above a ceiling.

B. Type C

1. Pipe: Slip the insulation over the pipe wherever possible or slit the insulation sections and apply around the pipe. Seal seams and joints with ArmaFlex 520 adhesive or equivalent to prevent the passage of air to the surface being insulated.
2. Fittings, Valves, and Pipe Specialties: Fabricate segments of insulation, miter joints using preformed pipe insulation and sections of pipe insulation in accordance with manufacturer's instructions or use prefabricated fittings from the manufacturer or recommended third party. Seal with manufacturer's adhesive to prevent the passage of air to the surface being insulated.

    a. Fill voids with cut sections of insulation same thickness as pipe insulation.
    b. Arrange insulation on valves to permit access to packing and to allow valve operation without disturbing insulation.

3. Outdoors:

    a. Apply two coats of WB Armaflex finish, or approved equal, in accordance with manufacturer's instructions and recommendations.
    b. Locate seams on lower half of the pipe.

C. Type E:

1. Wrap insulation around duct and seal joints in accordance with manufacturer's instructions. Use of adhesive to attach insulation to duct is prohibited.
2. Secure insulation on ducts with long sides or diameters exceeding 24 inches with pins welded or adhered on 18-inch centers. Secure pins with speed clip washers.
3. Butt insulation joints with reinforced foil face extending 2 inches beyond the insulation for lagging and seal flaps with Type A1 adhesive.
4. Use stainless steel staples to assist in securing insulation approximately 6 inches on center with 1/2-inch outward clinching staples. Seal vapor barrier penetration with Type M1 Mastic.
5. On rectangular and square ducts, install so insulation is not excessively compressed at corners.

D. Type F

1. Apply to duct, staggering longitudinal joints to provide a complete and tight fit to the contour of the duct surface on the exterior.
2. Seal longitudinal joint jacket overlaps and 4-inch wide sealing strips of jacket material applied on circumferential joints with Type A1 adhesive or self-sealing laps.
3. Use stainless steel staples to assist in securing scored board insulation where joint is hidden.

E. Type G

1. Application:

    a. Secure insulation with pins welded or adhered to sheet metal on 15-inch centers. Cut side pieces of insulation to lap top and bottom pieces. Apply Type A1 adhesive to entire underside of horizontal metal surfaces. Secure 1-1/2-inch diameter fiber or tin-coated disk to pins.
    b. Protect outer corners of insulation with 3-by-3-inch aluminum angles or roll-on corner angle.

c. Butt insulation joints, seal with 4-inch vapor barrier foil tape or 2-inch laps adhered with Type A1 adhesive. Seal over penetrations and disks with tape or Type M1 mastic.

2. Surface Finish:

a. Imbed glass-reinforcing fabric, 20-by-20 mesh (1-1/2-ounce minimum) in tack coat of Type C1 coating (2 gallons in accordance with 100 square foot) lapping joints a minimum of 2 inches.
b. Finish when dry with final coat of Type C1 coating (4 gallons in accordance with 100 square foot).

F. Type H

1. Application:

a. Secure insulation with pins welded or adhered to sheet metal on 15-inch centers. Cut side pieces of insulation to lap top and bottom pieces. Apply Type A1 adhesive to entire underside of horizontal metal surfaces. Secure 1-1/2-inch diameter fiber or tin-coated disk to pins.
b. Protect outer corners of insulation with 3-by-3-inch aluminum angles or roll-on corner bead.
c. Butt insulation joints, seal with 4-inch vapor barrier foil tape or 2-inch laps adhered with Type A1 adhesive. Seal over penetrations and disks with Type M3 mastic.

2. Surface Finish: Apply two 1/16-inch thick coats of white Type M3 mastic with a glass reinforcing fabric, 20-by-20 mesh (1-1/2-ounce minimum) between coats, lapping joints a minimum of 2 inches to form a weatherproof finish.

G. Type O

1. Square and Rectangular Ductwork

a. Slope top of the ductwork insulation a minimum of 2 degrees angle to prevent “ponding” of water.
b. The duct insulation shall be constructed from the bottom up, with the top insulation sized to extend over the side insulation to form a watershed.

2. Round Ductwork

a. Insulation shall be wrapped not stretched around the duct.

(1) On ductwork larger than 12 inches in diameter, the insulation shall be adhered to the duct surface on the lower one third.
(2) On ductwork greater than 24 inches in diameter, the insulation shall be completely adhered to the duct surface. Longitudinal seams shall be located on the lower half of any round ductwork.

3. Non-adhesive insulation shall be adhered directly to clean, oil-free surfaces with a full coverage of ArmaFlex 520 adhesive or equivalent. Self-adhering insulation shall be adhered directly to clean, oil-free surfaces.
4. Apply pipe insulation at ambient temperatures of 40 degrees F or above.
5. Butt-edge seams shall be installed in accordance with manufacturer's instructions and recommendations.
6. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams may be covered using strips of sheet insulation or half sections of tubular pipe insulation with miter-cut ends. Standing seams shall be adhered using ArmaFlex 520 adhesive or equivalent.
7. Insulation seams shall be staggered when applying multiple layers of insulation.

3.4 INSTALLATION SCHEDULE

A. Piping

PIPING SYSTEM	MATERIAL TYPE	INSULATION THICKNESS IN INCHES FOR PIPE SIZE				
		Less than 1"	1 to less than 1-1/2"	1-1/2 to less than 4"	4 to less than 8"	8" & Larger
Outdoor Refrigerant Suction and Hot Gas (Note 1)	C	2	2	2	2	2
Indoor Refrigerant Suction; Hot Gas; and Outdoor and Indoor Refrigerant Liquid (Note 1)	C	1	1	1	1	1-1/2
Air Conditioning Condensate	A (Note 5) C (Note 6) (Note 2)	1/2 3/4	1/2 3/4	1 1	1 1	1 1

B. Ductwork (Note 3)

FOR AIR SYSTEMS TRANSPORTING AIR AT 48 DEGREES F AND ABOVE	MATERIAL TYPE	INSULATION THICKNESS (INCHES)
Outdoors	H, O	3
Concealed	E	2 (Note 43)
Exposed Rectangular	G	2
Exposed Round	F	1-1/2
Sound Attenuators	Same as Connecting Duct	

Note 1: Locate hangers outside of insulation with saddles or thermal shields specified under another section. In the saddle, provide a half section of calcium silicate or cellular glass equal in thickness to adjoining insulation or load-bearing PET core, equal to ArmaFix Ecolight, where applicable, sized to support, protect, and carry the load without being crushed or damaged, and vapor sealed maintaining

the thermal integrity of the system. Insulate supports and anchors in contact with pipe the same as piping.

Note 2: Type C may be used in lieu of Type A, where indicated at Contractor's option, for insulation thickness up through 2-inch except where heavy-duty finish is required.

Note 3: If insulated ductwork is supported from the bottom, provide calcium silicate or cellular glass equal to thickness of the adjoining insulation at the support. Vapor seal and size to carry the load without crushing.

Note 4: Installed insulation shall be R-6. If not achievable with 2-inch thickness, increase insulation thickness as necessary to comply.

Note 5: Indoor application only.

Note 6: Indoor and Outdoor application.

3.5 EXTENT OF INSULATION

A. Piping: Insulate as designated in Installation Schedule.

B. Ductwork and Plenums: Insulate the following:

1. Outdoor air.
2. Return air (within non-conditioned spaces).
3. Supply air.
4. Air terminal unit sound attenuators, primary inlets and reheat coil casing.
5. Supply, Return, and Exhaust ducts located above roof and outside of building.
6. Relief and exhaust air ductwork and plenum between motor operated damper or gravity backdraft damper and penetration of building exterior.
7. Intake and exhaust air plenums.
8. Sound Attenuators.

END OF SECTION 23 07 00

SECTION 23 09 23 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Complete automatic control system as required for automatic operation of heating, ventilating and air conditioning systems including controllers, operators, valves, dampers, control cabinets, and accessories.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 – Testing, Adjusting, and Balancing

D. Section 23 20 00 - Building Services Piping

E. Section 23 31 13 – Ductwork

F. Section 23 33 00 - Air Duct Accessories

G. Section 23 36 16 - Air Terminal Units

H. Section 23 70 20 – Packaged Rooftop Units

I. Section 23 81 26 – Split System Air Conditioners

J. Division 26 – Electrical

K. Division 28 - Electronic Safety and Security

1.3 QUALITY ASSURANCE

A. Electrical work shall comply with NFPA 70, National Electrical Code.

B. Electronic Control System

1. The automatic control system shall be an open architecture system with native BACnet Architecture.
2. System controllers shall be a UL approved signaling system and shall comply with the latest Federal Communications Commission regulations.
3. The automatic control system contractor shall be responsible for quantity and type of controllers to make the control system fully operational.

C. Controls, operators, setups, and components shall be provided under this section to provide a system capable of operating as defined in the sequence of operations indicated on the drawings.

D. Automatic control system subcontractor shall refer to Section 23 36 16, “Air Terminal Units,” for single duct air conditioning terminal units. Controls, operators, setups and components shall be provided under this section to provide a system capable of operating as defined in the sequence of operations indicated on the drawings.

E. Automatic control system subcontractor shall be responsible for providing quantity and type of transformers to make their system operational, except where transformers are furnished and mounted by the equipment manufacturer.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Schematic wiring and control diagrams including graphic system representation, operating sequences, and control description for entire system.

C. Carbon dioxide sensors.

D. Damper schedule.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Packaged Rooftop Units: Controls for the packaged rooftop unit shall be by the unit manufacturer, unless otherwise noted. The Electronic Control system shall interface with functions as described in the Contract Document. Automatic Control Subcontractor shall be responsible for control of the air terminal units, including static pressure sensing device, terminal unit controllers, carbon dioxide sensors, airflow monitors, etc.

B. Control of unit heaters is by cycling fans and it shall be provided using line voltage thermostats.

PART 2 - PRODUCTS

2.1 AUTOMATIC CONTROL SYSTEM

A. Automatic control system shall be electronic or electric control, electric actuation complete with necessary electrical interlocks, protective devices and associated control wiring.

B. Control shall be performed by a field programmable controller, microprocessor based, which incorporates control, energy management functions, and provides for digital display and local adjustments of desired variables at the control cabinet.

C. Controllers, operators, dampers, panels, and other control devices shall generally be the standard product of one manufacturer.

D. Manufacturers: Automated Logic, Honeywell, Invensys, I-Vu Facility Automation System, Johnson Controls, Siemens Building Technologies, Inc.

2.2 CONTROLLERS

A. Type: Proportional or positive action (for on-off control) with adjustable set point and modulating range or differential. Controllers, mounted on control panels, shall be remote sensing.

B. Controllers for air handling unit supply air temperature and elsewhere as indicated shall be PID adjusted for stable modulating range, yet limiting deviation from control point of 1 degree F.

C. Room Temperature Sensors:

1. Adjustable Range:

    a. Heating Control: 55 to 75 degrees F.
    b. Cooling Control: 70 to 85 degrees F.
    c. Heating and Cooling Control: 55 to 85 degrees F.

2. Fixed modulating range is permissible for unit thermostats.
3. Equip day-night temperature sensors with external manual reset to "Day" with automatic recycle.
4. Temperature sensors must be suitable for field calibration.
5. Provide specific features as indicated:

    a. Deadband temperature sensors shall have two distinct setpoints with a 10 degrees F adjustable deadband between heating and cooling setpoints. Minimum deadband shall be 5 degrees F, unless otherwise noted.
    b. Equip temperature sensors with digital display.
    c. Provide temperature sensors with concealed adjustment.

D. Safety Controls

1. Electric freezestats shall have manual reset feature.
2. Electric freezestats shall respond to lowest temperature sensed by any foot of 20-foot segment element.
3. Smoke detectors for duct system are furnished under Section 28 31 11, “Addressable Fire Alarm System.”

2.3 OPERATORS

A. Operators shall return to open or closed position as required to minimize possibilities of freezing, system malfunction or overheating upon system shutdown, changeover, or power failure.

B. Operators shall be quiet and have ample power to provide smooth, repeatable proportional positioning under all operating conditions, and shall be rated to allow for motor, damper or valve deterioration.

C. Sequencing of operation for shall be software programmable.

D. Provide one motor for each damper section.

E. Coordinate requirement of operators for air terminal units with manufacturer.

2.4 DAMPERS

A. Construction

1. Blades: Reinforced or double panel galvanized steel or aluminum. Interlocking edges or compressible all-weather seals. Maximum blade width and length, 8 by 48 inches.
2. Bearings: Nylon or Oilite.
3. Frame: Heavy galvanized or aluminum channel braced at corners.
4. Linkages: Adjustable length with brass pin-clevis or ball-socket joints free of excessive play, accessible on front of damper.
5. Protect all steel parts with two coats rust inhibiting paint or galvanizing.
6. Construct duct-located dampers as specified with frames totally recessed out of the airstream. Pressure drop through full open damper shall not exceed 0.15-inch static pressure at 2000 FPM face velocity. Limit stop penetration into air stream to 1/2-inch.
7. Outdoor intake, plenum or duct shutoff dampers shall be low leakage dampers.
8. Dampers shall be structurally suitable for operation with pressure differentials encountered in system. See Section 23 31 13, “Ducts and Duct Accessories,” for System Pressure Rating.
9. Select and arrange dampers for air mixing to provide convergent airflow to minimize stratification.

B. Characteristics

1. Flow characteristics with respect to operator travel shall approximate the following:
   Mixing Service: Linear
   Throttling: Equal percentage
2. Characterized linkages shall be used where required to achieve these results.

2.5 CONTROL CABINETS

A. Flush-mount controls on 16 gage steel panel or fire-resistant plastic laminated board or surface mount within steel cabinet with hinged door and latching lock. Multiple cabinets shall utilize one master key.

B. Finish: Grey, beige, or green, mat surface.

C. Provide nameplates identifying controls and unit or system.

D. Wiring: Prewire all panel wiring terminating at concealed terminal strip.

E. Permanently imprint graphic illustration of the system and controls on the panel face or door.

F. Indicating controllers or calibrated receiver gages with 1 percent of scale minimum accuracy with 3-1/2-inch round, or 6-inch minimum length scale, and other features as specified in Section 23 20 00, "Building Services Piping," may be used in lieu of thermometers and pressure gages, where specified to be mounted on equipment control panels.

2.6 ELECTRIC WIRING AND CONTROL

A. Electrical work shall conform to the Electrical Division requirements except as modified below.

B. Minimum wire size shall conform to NFPA 70 (National Electrical Code) requirements.

C. Minimum Conduits Size: 3/4-inch, conduit mounted outdoors or in damp areas shall be rigid.

D. Class 1 Wiring (Greater than 30 volts): Install in conduit in accordance with NFPA 70 (National Electrical Code).

E. Class 2 Wiring (30 volts or less): Remote control and signal wiring may be run in multi-conductor cable with PVC insulation, Mylar binder and PVC jacket. Digital transmission shall be through twisted, shielded pair. Entire installation shall be in accordance with NFPA 70 (National Electrical Code), and shall meet additional requirements noted.

F. Cables carrying AC circuits sensitive to external fields shall be shielded.

G. All new circuits shall have a green-grounding conductor sized in accordance with Article 250 of NFPA 70 (National Electrical Code).

H. No more than eight current-carrying conductors shall be placed in a single conductor.

I. Materials installed in plenums used to transport supply or return air shall be plenum-rated and meet applicable code requirements.

J. Furnish control transformers with steel enclosures with separate primary and secondary compartments, each with conduit connections.

K. Secondary side of control transformer shall be fused.

L. Controllers and Operators

1. All controls shall be designed to function properly with a power source voltage variation of plus or minus 10 percent.
2. Operators shall be hydraulic, thermal or gear type, totally enclosed with oil immersed gear.
3. Select speed of operation to prevent hunting.

2.7 APPLICATION SPECIFIC CONTROLLERS

A. A dedicated controller shall be configured and provided for each primary HVAC system (air handler, including interlocked equipment)) and each Terminal HVAC system (Air Terminal Units).

B. Each controller shall retain program, control algorithms, and setpoint information for at least 72 hours in the event of a power failure and shall return to normal operation upon stable restoration of normal line power.

C. For each primary HVAC system, provide means of indication of system performance and setpoints at the controller.

D. For each primary HVAC system, provide a means to adjust setpoints and start/stop equipment through the controller.

E. Provide a means to prevent unauthorized personnel form accessing setpoint adjustments and equipment control definitions.

F. The controller shall provide the functionality to download and upload configuration data, both locally at the controller and via the communications Network.

G. Control Cabinet

1. Enclose the controller in a control cabinet. Construct cabinet such that it can be mounted and electrical terminations made during the construction phase of the project. Remove the controller electronics and reinstall at a later phase, i.e., commissioning of the system.
2. Control wiring and system communications shall be electrically terminated inside the controller cabinet.

PART 3 - EXECUTION

3.1 AUTOMATIC CONTROL SYSTEM

A. Automatic control system contractor shall install and adjust entire control system and supervise initial operation with mechanics or subcontractors in his employ.

B. Provide all field connections, relays, control transfer switches necessary for interlocking starters of supply fans with return or exhaust fan.

C. Identify gages and controls. Note normal conditions with permanent markings.

D. Control Diagrams

1. Submit in accordance with Section 23 05 00, “Basic Mechanical Materials and Methods,” black line schematic wiring and control piping diagrams including graphic system representation, operating sequence and control description for entire system.
2. Submit damper schedule.
3. Submit carbon dioxide sensor schedule.

4. Upon completion of work, mount one "as built" set of diagrams in control panel associated with diagram.

3.2 CONTROLLERS

A. Mount all controllers securely at accessible, vibration free locations.

B. Housings for controls inside ducts shall be streamlined. Location subject to Engineer's approval.

C. Field check calibration and adjustment of all controllers.

D. Sensing Elements

1. Locate where responsive to representative temperatures or minimum temperature for low limit or freeze protection temperature sensors.
2. Provide elements with firm support and insulate from direct contact with coils or other heat conductors.
3. Protect capillaries between element and controller where exposed to damage with flexible armor or conduit.

E. Room Temperature Sensors:

1. Mount room temperature sensors located on outside walls on insulated subbases.
2. Mount unit type thermostats centered below access door.

F. Safety Controls

1. All safety controls and control interlocks shall be hardwired and remain active with the motor start H-O-A switch in the "Hand," "Off," and "Automatic" positions.
3. Smoke detectors shall be furnished and connected with power to operators from the fire alarm system to low voltage operators or transformers under Section 28 31 11, "Addressable Fire Alarm System."

3.3 OPERATORS

Furnish operators for air terminal units to unit manufacturer if required for compatibility.

3.4 DAMPERS

A. Install in a manner to allow access to operators and linkages, and to provide the intended function.

B. Lubricate damper pivot points with graphite impregnated oil before system start-up and again before systems are turned over to the Owner. Maintain record of date of lubrication of each damper.

3.5 CONTROL CABINETS

A. Provide at a location approved by the Engineer, adjacent to the equipment being controlled.

B. Support panel from floor or building wall on steel legs or brackets allowing adequate access for servicing of controls.

C. Provide primer and finish coat of black enamel on supports.

D. Transmitters: Where distances between sensing element and panel mounted controller exceed recommended capillary length, provide signal transmission from sensor to controller.

3.6 ELECTRIC WIRING AND CONTROL

A. Obtain control power from the 120-volt power panel RPHVAC. See Electrical Drawings for panel locations. Provide breaker in empty space in panel properly sized for load. Provide separate breaker for each control cabinet.

B. Control power may be derived from line side of a starter provided circuit is fused and all controls so energized are associated only with this starter and motor.

C. Control transformer furnished as an integral part of a starter shall not be used as a power source for additional control.

D. Starter disconnect or separate switch immediately adjacent to starter shall disconnect power from all line voltage or 120-volt control wiring entering starter.

3.7 COORDINATION WITH TESTING, ADJUSTING, AND BALANCING CONTRACTOR

The Automatic Control System (ACS) Contractor shall put the system in the required mode of operation as requested by the Testing and Balancing (TAB) Contractor. All programming changes and reporting of data from the Building Automation System (BAS) needed to achieve proper performance shall be done by the ACS Contractor. The TAB Contractor shall be the lead Subcontractor in coordinating his work and the ACS Contractor's work. All work is by the TAB Contractor unless noted as being the responsibility of the ACS Contractor.

1. Accuracy of the terminal unit flow readings as read by the ACS Subcontractor from the DDC system shall be certified through measurements by the TAB Subcontractor.
2. The ACS Subcontractor shall place the terminal unit in a "Test" mode which will cause all terminal units to control to design maximum flow.
3. The TAB Subcontractor shall request the system be placed in the "Test" mode by the ACS Subcontractor one time, and then be responsible to record the flows at maximum and minimum flow settings for all units. The TAB Subcontractor shall select the minimum flow settings as required.
4. Report any deviations in excess of plus or minus 10 percent to the Engineer as soon as possible so corrective action by the Mechanical or ACS Subcontractors can be performed. These problem areas may require remeasuring by the TAB Subcontractor.
5. The ACS Subcontractor shall, after receipt of all terminal unit data, change any programming necessary to correct the flows to the values measured by the TAB Subcontractor.

6. The supply and static pressure control setpoint shall be rechecked by the ACS Subcontractor to ensure that the static pressure setpoint is the lowest value which enables all terminal units to deliver the design maximum flow, plus or minus 10 percent, with the variable speed drive at maximum speed. The TAB Subcontractor shall make any fan adjustments needed.

END OF SECTION 23 09 23

SECTION 23 00 0 - BUILDING SERVICES PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Piping, fittings, joints, valves, and supports for Divisions 21 and 23.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 21 13 00 - Fire Suppression

C. Section 23 05 00 - Basic Mechanical Materials and Methods

D. Section 23 05 48 - Mechanical Sound and Vibration Control

E. Section 23 05 93 - Testing, Adjusting, and Balancing

F. Section 23 07 00 - Mechanical Insulation

G. Section 23 70 20 - Packaged Rooftop Units

H. Section 23 81 26 - Split System Air Conditioners

1.3 QUALITY ASSURANCE

A. Valves shall conform to ASME Boiler and Pressure Vessel Code Specifications where indicated or required by state or local code.

B. All grooved joint couplings, fittings, valves, check valves, strainers, etc. shall be the product of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc. shall be stamped for quality assurance and traceability.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Statement of piping and fitting material, and type of joint to be used for each piping system.

C. Manufacturer's technical product data, installation instructions and description of accessories for each type to be used and system designation:

Valves
Pipe Supports
Insulation Protection
Pressure Gages and Test Connections

D. Test reports for refrigeration and natural gas piping.

E. Tests for fire suppression piping.

F. Grooved joint product submittals shall specifically identify the applicable manufacturer's product style or series number.

1.5 APPLICABLE PUBLICATIONS

The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Workmanship

1. Cut pipes accurately to measurements established at structure.
2. Install without springing or forcing.
3. Clear windows, doors, and other openings.
4. Permit expansion and contraction without misalignment or damage.
5. During construction, close openings in piping and equipment to keep out foreign matter and to prevent leakage.
6. Piping shall be concealed unless otherwise indicated.
7. Provide offsets required to avoid structural or other interference without extra cost to the Owner.

B. Drainage

1. Grade to low points.
2. Provide hose end drain valves at bottom of risers, low points, and where indicated.

C. Access: All valves, unions and flanges shall be installed in accessible locations.

PART 2 - PRODUCTS

2.1 FITTINGS AND ACCESSORIES

A. Reducers: Reducing fittings, eccentric type where required to prevent pocketing of air and water.

B. Unions, Flanges, Mechanical Couplings, and Gaskets

1. Suitable for intended duty and rated for not less than system test pressure.
2. Dielectric (insulating) type in water piping systems, suitable for intended service.

2.2 PIPE, FITTINGS AND JOINTS

A. Pipe

TYPE	REFERENCE
E	Black Steel Pipe: American Steel only in compliance with ASME B31.9; ASTM A53 Grade B, ERW or seamless; or ASTM A106 Grade B seamless. Sizes through 10 inches, standard weight, 12 inches and larger 3/8-inch wall.
L	Seamless Copper Water Tube: ASTM B88, Type "L" hard temper; ASTM B280 for Type ACR.

B. Fittings

TYPE	REFERENCE
BB	Wrought Copper Solder Joint Fittings: ANSI/ASME B16.22.
EE	Galvanized Malleable Iron Screwed Fittings: 150 psi, ANSI/ASME B16.3.
FF	Black Cast Iron Screwed Fittings: 125 psi steam, 175 psi water, ANSI/ASME B16.4.
QQ	Factory Grooved End Fittings: UL listed ASTM A395 and A536 ductile iron; ASTM A234 forged steel; or factory fabricated from carbon steel pipe conforming to ASTM A53. Anvil, Central Sprinkler, or Victaulic equal to Victaulic standard dimension or Firelock type UL/FM approved for fire protection service, or approved equal. Tees equal to Victualic Style 002. Sprinkler Head Connection: Direct sprinkler head connections, branch connections, drop nipples, and sprigs shall be Victaulic 922 outlet connections, or approved equal.

C. Joints

TYPE	REFERENCE
1	Threaded-American Standard for Pipe Threads: ANSI B1.20.
7	Soldered: ASTM B32; Tin-antimony, 95-5, tin silver 96-4, or tin silver 94-6.
9	Brazed-Silver Alloy Brazing equal to Sil-Fos and Easy-Flow by Handy and Harman.
11	Mechanical Couplings: Anvil, Central Sprinkler, or Victaulic equal to Victaulic Style 005, 009 or 107N zero-flex rigid couplings or Victaulic Style 75 or 177 flexible couplings with gaskets suitable for minus 30 to 230 degrees F continuous temperature, lubricated per manufacturer's recommendation. Victaulic Style 75, 177 or approved equal shall be limited to connections at equipment and where indicated on drawings.Gasket-Neoprene Double Seal Compression Type: ASTM C564 for hub and spigot cast iron pipe couplings.

2.3 VALVES

A. Manufacturer's Tests: Each valve shall be given shell and seat tests by the manufacturer and shall carry a permanently affixed indication that tests have been successfully completed.

B. Drain Valves: Hose end ball valve with cap and chain equal to NIBCO Fig. T-585-70-HC ball valve with American Standard Garden Hose type threads. Drain valves on potable water systems shall include a vacuum breaker hose connection.

C. Silent Check Valves: Equivalent to Mueller Steam Company figure numbers as follows:

1. Two-inch and Larger:

    a. Figure 105M, globe type, flanged. Body: Cast iron, ASTM QA126, Class B or carbon steel ASTM A216, Class WCB.

2. One-half to 1-1/2-inch: Figure 303, threaded. Body: Bronze, ASTM B62.
3. Seat Disc, Spring:

    a. Stainless steel springs and guides with stainless steel or bronze ASTM B62 disc and seat.

4. Manufacturers: Milwaukee, NIBCO, Williams-Hager, APCO Valve and Primer Co., Hammond, Mueller Steam, Miller Valve Co.; Steamflo.

D. Gate, Globe, and Check Valves

1. Gate and globe valves designed for repacking under pressure when fully opened, and equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. Each gate and globe valve shall have a gland follower.
2. Bronze valves with the basic saturated steam rating of 125 psi or 150 psi shall have pressure containing parts of a material having at least the physical properties of ASTM Specification B-62. Metallic seated bronze globe, angle, check and gate valves with a basic steam rating of 200 or 300 psi having pressure containing parts of material conforming to ASTM B-61, for temperatures to 550 degrees F.
3. Solid wedge type gate valves, designed and manufactured in such a way that seating surfaces are prevented from contacting until near the point of closure.
4. Handwheels of ASTM A47 malleable iron or ASTM A126, Class A or B iron.
5. Manufacturers: Unless otherwise indicated, Apollo, Centerline, Crane, Milwaukee, Nibco, or other listed manufacturer figure numbers as noted in paragraph, Schedule of Services.

E. Ball Valves

1. Ball valves shall have stem extension to place handle outside the insulation when valve is to be installed in insulated piping.
2. Type A: Bronze or brass body, bronze or brass ball and stem, reinforced Teflon seats and seals, full port size, threaded or solder end as required scheduled through 2-inch size and acceptable for 2-1/2-inch size if valve is full port. Valve shall be three-piece or shall have removable cartridge to permit complete access removal, and replacement of components

without removal of the valve from the piping system and without disturbing the piping system. NIBCO 595-Y.

Manufacturers: Unless otherwise indicated, Apollo, Contromatics, Crane, Dynaquip, Fairbanks, Hammond, ITT Grinnell, Jamesbury, MarPac, Milwaukee, NIBCO, Powell, Watts, Webstone, Worcester for the types listed in Schedule of Services.

E. Schedule of Services: Unless otherwise indicated, valves are for aboveground service. Size range indicated is size of pipe where valves are required. Valves shall be pipe size or larger.

REFRIGERANT				
TYPE	SIZE RANGE	SPECIFIC REQUIREMENTS	STYLE	FIGURE NO.
Packless Globe	1/4-1-1/8-inch ODS	-	-	Henry 626
Wing Cap	1-3/8 - 4-3/8-inch ODS	-	-	Henry 203

GAS				
TYPE	**SIZE RANGE**	**SPECIFIC REQUIREMENTS**	**STYLE**	**FIGURE NO.**
Cocks	2-inch (50 mm) and Smaller	-	Bronze	Crane 270*
Solenoid	-	-	-	ASCO **
Ball	3/8-2-inch	2-piece Full Port; AGA & UL Listed	-	NIBCO TFP-600-AGA & UL*
* Tested for Gas Service ** Approved for Combustion Fuel Gas Safety Shutoff				

PUMP DISCHARGE				
TYPE	**SIZE RANGE**	**SPECIFIC REQUIREMENTS**	**STYLE**	**FIGURE NO.**
Ball	2-inch and Smaller	-	-	Type A
Check	2-inch and Smaller	-	Screwed End Soldered End	NIBCO T-433-B NIBCO S-433-B

2.4 EQUIPMENT RAILS

A. Furnish equipment rails equal to Roof Products and Systems Corporation, Model ER-4B, where indicated on the drawings.

B. Equipment rails shall be manufactured of 18 gage galvanized steel, fully mitered and welded corners, 3-inch cant. Equipment rails shall be internally reinforced with integral baseplate and factory installed 2 by 8-inch wood nailer. Height shall be 18 inches above finished roof.

C. Manufacturers: Pate, Roof Products and Systems Corp.

2.5 PIPE SUPPORTS

A. General: Supports shall be plastic coated for plastic pipe, copper plated for copper tubing and brass pipe, galvanized for uninsulated galvanized steel pipe, and black steel for other metallic piping. Outdoor supports shall be copper plated for copper tubing and brass piping, and galvanized for all other piping.

B. Horizontal Piping

1. Clevis Hangers: Adjustable wrought steel clevis hangers.
2. Under Supports:

a. Where no provision for expansion and contraction is required:

(1) Floor Mounted: Adjustable cast iron saddle with floor flanges secured to floor and pipe nipple of suitable length.
(2) Trapeze or Metal Frame Mounted: Inverted U bolts with saddle supports for insulated pipe.
(3) Wall Mounted: Steel J hooks for pipes 3-inch and smaller; welded steel brackets for larger pipes with hanger or support same as for trapeze.

3. Metal Frame Supports:

a. Provide as required, vertical and horizontal 12 gage galvanized steel channels and fittings bolted together to form a multiple pipe rack secured to the building structure with post bases and brackets. Equal to Grinnell Power-Struct, ASTM A-446, Grade A, hot dipped zinc coated steel with safety end enclosures.
b. Manufacturers: B-Line, Steel City, Unistrut, Grinnell.

C. Vertical Piping

1. Steel extension pipe clamps for piping not subject to vertical movement by expansion or contraction.

D. Insulation Protection

1. Saddle: 18 gage galvanized sheet metal.
2. Thermal Shield: 360 degree insert of waterproofed calcium silicate insulation with 100 psi compressive strength encased in galvanized steel jacket equivalent to Pipe Shields, Inc. Model A2000 (CS-CW Series) for refrigerant lines and Model A1000 (CS) for other insulated lines. Use Model A4000 (CSX-CW) and Model A3000 (CSX) wherever pipe hanger span exceeds 10 feet. Insert shall be same thickness as adjoining pipe insulation. Shield length and minimum sheet metal gages as indicated. Insulation insert shall extend 1-inch beyond sheet metal shield on refrigerant piping. Where pipe hanger spacing exceeds 10 feet, provide double layer shield on bearing surface.
3. Manufacturers: B-Line, Pipe Shields, Inc., Value Engineered Products.

PIPE SIZE IN INCHES (mm)	SHIELD LENGTH IN INCHES	MINIMUM GAGE
1/2 – 1-1/2 (15-40)	4	26
2 – 6 (50-150)	6	20

2.6 PIPE PEDESTALS

A. Furnish pipe mounting pedestals equal to Roof Products and System Corp., Model ER-4A, where indicated on the drawings. The pipe mounting pedestal shall include equipment rail, sized for the number of pipes and specified in this section, as associated galvanized steel slide channel attached to "U" shaped mounting brackets and secured to side of equipment rails with lag bolts supplied. The pipe roller assembly shall have galvanized 18-inch long continuous threaded rod to give 12-inch vertical adjustment, galvanized removable pipe retainer bracket for 12-inch horizontal adjustment. All pipe mounting pedestals shall be factory assembled.

B. Manufacturers: Caddy Pyramid, Pate, Roof Products and Systems Corporation.

2.7 PRESSURE GAGES AND TEST CONNECTIONS

A. Type: General purpose bronze bourdon tube, bronze bushed movement mounted on socket independent of case, 1 percent minimum accuracy at mid range, 4-l/2-inch white face equal to Ashcroft Catalog No. P2070A.

B. Ranges: Approximately twice the maximum operating pressure. Provide compound gages wherever negative pressures can occur.

C. Accessories: Provide gages with Trerice No. 735 or 740 valve suitable for intended pressure, temperature and service. For pump suction and discharge, provide porous core snubbers.

D. Manufacturers: Ashcroft, Marsh, Marshalltown, Moeller, Taylor, Tel-Tru, Trerice, U.S. Gage, Weiss, Weksler, Weston, Winters.

E. Test Connections: Provide with Trerice No. 735 or 740 gage valves suitable for intended pressure.

PART 3 - EXECUTION

3.1 FITTINGS AND ACCESSORIES

A. Reducers: Use reducing fittings to make changes in pipe sizes.

B. Brazing: Provide a dry nitrogen purge during brazing operations for copper pipe. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

C. Threads: Remove burrs and ream to full inside diameter.

D. Unions, Flanges, Mechanical Couplings, and Gaskets

1. Install at each piece of equipment, in bypasses, and long piping runs to permit disassembly for alteration and repairs.
2. Equipment Connections: Provide piping connections which conform to indicated sizes, details, reviewed shop drawings, and printed installation instructions furnished by manufacturer.

3. Dielectric (Insulating) Type: Install in water piping systems where pipes of dissimilar metals are joined and where unions are required by contract documents.
4. Contractor shall install tongue and recess mechanical couplings with a torque wrench in accordance with manufacturer's recommendations. Use of an impact wrench is not permitted on tongue and recess mechanical couplings.

3.2 PIPE, FITTINGS AND JOINTS

A. Schedule

SYSTEM	PIPE	FITTINGS	JOINTS
Refrigeration Piping * Type ACR			
1. Aboveground	L*	BB	9
Air Conditioning Condensate, Air Conditioning Condensate Pumped Discharge			
1. Aboveground: 2-inch and smaller	L	BB	7
Gas, Gas Relief			
1. Aboveground: 4-inch and smaller	E	EE	1
Fire Suppression			
a. 2-1/2-inch and larger	E	QQ	11
b. 2-inch and smaller	E	FF	1

NOTES:

(1) Type A and G not permitted above food or beverage storage, preparation, dining, serving areas; operating rooms; not permitted for sump and sewage ejector pump discharge piping.

3.3 VALVES

A. Adjust for smooth and easy operation.

B. Install in locations where valve can easily be adjusted.

C. Install valves full size of pipe before reducing size to make connection to equipment and controls.

D. Remove excess solder and other foreign matter from valve interior after installation before operating valve.

E. Cut Off or Stop Service: Gate or ball, as specified.

F. Silent Check Valves: Install in pump discharge piping where check valves are indicated.

3.4 EQUIPMENT RAILS

A. Install in accordance with manufacturer's instructions and recommendations.

B. Height to bottom of rails shall be18 inches above finished roof.

3.5 PIPE SUPPORTS

A. Preparation and Application

1. Provide supports to maintain required slope and alignment.
2. Secure hangers to rods with double nuts.
3. Make allowance for expansion and contraction.
4. Do not support pipes from ducts or other pipes.
5. Use trapeze hangers for parallel runs of pipe with same slope.
6. Provide bracing to prevent lateral motion of horizontal or vertical piping.
7. Provide supports at or near changes in direction.
8. Do not pierce ducts with hanger rods.
9. Provide strength and rigidity suitable for loads imposed.
10. Support piping so there is no strain on the connection to equipment.
11. Support piping using mechanical couplings in accordance with manufacturer's instructions and recommendations.

B. Horizontal Piping

1. Adjustment: Provide vertical adjustment of supports for horizontal piping after installation.
2. Maximum Support Spacing:

    a. Steel Lines: 1-1/2-inch and smaller, 6 feet; 2-inch and larger, 10 feet.
    b. Copper Lines: 1-1/2-inch and smaller, 5 feet; 2-inch and larger, 8 feet.

3. Metal Frame Supports: Space frames in accordance with smallest pipe requirements and design for a maximum deflection of 1/360 of the span.

C. Vertical Piping

1. Support vertical lines at locations indicated. Where not indicated, support plastic, and copper pipe at every floor, steel pipe at every other floor, except for pipes carrying natural gas, which shall be supported at every floor. Brace plastic piping on maximum 6-foot centers.

D. Insulation Protection

1. For refrigerant piping, provide saddle for piping 4-inch and smaller.

    a. Saddle: For Refrigerant Piping," (refer to Section 23 07 00, “Mechanical Insulation” for extent) provide hangers outside of covering. Between hanger and covering, provide sheet metal saddle formed to fit bottom half of the insulation. Minimum side dimension of saddle equal to one half the insulation circumference.
    b. Thermal Shield: Provide 3-inch wide vapor barrier tape or band over butt joints. Where vapor barrier is required, apply a wet coat of vapor barrier lap cement on butt joints before applying tape or band. Coordinate with Section 23 07 00, "Mechanical Insulation."

2.6 PIPE PESDESTALS

Install in accordance with manufacturer's instructions and recommendations.

2.7 PRESSURE GAGES AND TEST CONNECTIONS

A. Install pressure gages at pressure control points and elsewhere as indicated.

B. Install test connections suitable for intended pressure in piping where indicated for testing.

3.6 PIPE TESTING

A. Preparation and Application

1. Test piping to prove tightness.
2. Test concealed piping before enclosing.
3. Replace and re-test pipe or fittings broken or damaged under test.
4. Remove or protect from damage items not designed to withstand testing pressure; e.g., control devices, and air vents.
5. Advise Owner prior to tests.

B. Standing Water Test

1. Plug and test drain piping with water by filling to the top of highest pipe.
2. Test sections of piping separately with a minimum head of 10 feet of water.
3. Piping shall show no leakage after standing for eight hours.

C. Pressure Testing

1. Test pressures shall be 1-1/2 times the system working pressures and a minimum of 100-psi, unless otherwise indicated.
2. Valves shall be open, but not backseated for packing check. However, it is permissible to test against a closed valve if the test pressure does not exceed the valve pressure rating at test temperature.
3. Blind flanges, or the equivalent, shall be used instead of valves for dead-end shutoff.
4. Inspect each joint for leakage while under test.
5. Maintain pressure tests for a minimum of four hours.
6. Perform refrigeration-piping tests in compliance with the American Standard Safety Code for Mechanical Refrigeration, ASA B9.l.
7. Maintain applicable safety methods while performing tests. These methods shall include but shall not be limited to applying pressure at increments of 25 psi, providing sufficient time to allow the piping to equalize strains, until specified test pressure is attained. The piping system shall be examined only when the pressure in it is not increasing.
8. Perform gas piping tests in compliance with NFPA 54.
9. Perform fire suppression piping tests in compliance with NFPA 13.

END OF SECTION 232000

SECTION 23 31 13 - DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Sheet metal ductwork, insulated flexible ductwork, and leakage testing.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 - Testing, Adjusting, and Balancing

D. Section 23 07 00 - Mechanical Insulation

E. Section 23 33 00 - Air Duct Accessories

~~E.~~F. Section 23 36 16 -- Air Terminal Units

G. Section 23 37 13 - Air Outlets and Inlets

H. Section 23 70 20 -- Packaged Rooftop Units

~~F.~~I. Section 23 81 26 - Split System Air Conditioners

1.3 QUALITY ASSURANCE

A. For details not specified, such as hangers, elbow construction, offsets, obstruction streamlining, branch connections, dampers, sealing, the following reference applies:

Sheet Metal and Air Conditioning Contractors National Association "HVAC Duct Construction Standards, Metal and Flexible," Third Edition, 2005 referred to herein as SMACNA-HVAC;

B. Insulated flexible duct including vapor barrier shall be Class I in accordance with NFPA 90A.

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

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B. Statement indicating compliance with SMACNA standards and specified system pressure ratings.

C. Manufacturer's technical product data, installation instructions and accessories for the following:

Single-wall rectangular ducts and fittings
Single-wall round ducts and fittings
Sheet metal materials
Insulated Flexible Duct
Sealants
Hangers and supports

D. Duct Design

1. Sheet metal thickness
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrications, assembly and spacing of hangers and supports.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Physical Interference: Provide offsets or changes in duct shape required to avoid structural or other interference without additional cost to the Government.

D. Ductwork dimensions indicated on the drawings are internal.

E. System Pressure Rating: Construct systems in accordance with the following pressure rating.

SYSTEM	PRESSURE RATING (INCHES-W.G.)
Return Air/ Exhaust Air/~~Transfer Air~~ Outdoor Air	(-)2
Supply Air~~/Outside Air~~	2

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PART 2 - PRODUCTS

2.1 FITTINGS AND ACCESSORIES

A. Elbows

1. Provide 90-degree elbows of radius construction wherever space permits and elsewhere of square construction. Construct 90-degree square elbows with double radius turning vanes unless otherwise indicated. If throat radius on curved elbows must be less than duct width, provide full-length metal turning vanes. Provide 3/4-inch trailing edge on turning vanes of 90 degree square elbows wherever elbow is less than one duct perimeter upstream of change in duct size or direction.
2. Where a size change must occur at a square elbow, extend runners from throat to heel and secure vanes on runners parallel with duct sides.
3. Unless otherwise indicated, provide offsets with 30-degree full radius elbows as maximum.
4. Turning vanes shall comply with SMACNA's "HVAC Duct Construction Standard - Metal and Flexible", Figures 4-3 and 4-4.

~~Open End Ducts on Return Systems: Provide 2 inch high flanges on all four sides of openings, same gage as duct.~~

B. Plenum Connections: Provide bellmouth type for round supply ducts connecting to apparatus casings; maximum 20 degrees transition angle for rectangular ducts.

C. Thermometers

1. Direct Mounting: 5-inch dial, externally calibrated, standard industrial bimetal, with stainless steel stems and cases equal to Weston Models 4503 and 4513. Stem length - minimum, one-half the depth of duct; maximum, 24 inches.

2. Where indicating points cannot be conveniently read or temperature correctly sensed, provide organic liquid filled protected capillary tube for remote mounting.

3. Range for Media Temperatures not Exceeding 100 degrees F: 25 to 125 degrees F except minus 40 to 120 degrees F for outdoor air.

4. Range for Media Temperatures above 100 degrees F, but not exceeding 220 degrees F: 30 to 240 degrees F.

5. Accessories: Provide with flanges and separable brass bushing with insulation extension on insulated ductwork.

~~B.~~6. Manufacturers: Ashcroft, Marsh, Marshalltown, Moeller, Taylor, Tel-Tru, Trerice, U.S. Gage, Weiss, Weksler, Weston, Winters.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

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A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Unless otherwise indicated, 90 degree elbows shall be 5 sections or die formed; and 90 degree branch connections shall be long or bell formed conical.

E. Manufacturers: Spiral conduit and fittings - Eastern Sheetmetal, Hamlin, Lindab, McGill Airflow Corp., Monroe, Semco.

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2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 INSULATED FLEXIBLE DUCT

A. Spiral wound metal reinforced coated glass fabric, factory insulated with 1-inch, 3/4 pound density insulation with flexible outer vapor barrier, equal to Thermaflex M-KC.

B. Duct shall be rated for 10-inch w.g. positive, 2-inch w.g. negative pressure, 0 to 180 degrees F continuous temperature, and 4000 fpm air velocity.

C. Manufacturers: Flexmaster, Genflex, Thermaflex, Wiremold.

2.6 SEALING COMPOUND

Childers CP-146, McGill Airseal Corp. "United Duct Sealer," Foster 32-14, Hardcast, Inc.

PART 3 - EXECUTION

3.1 FITTINGS AND ACCESSORIES

A. Damper and Louver Frames: Bolt and seal damper and louver frames to duct, casing or masonry openings.

B. Provide duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized steel ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Vibration: Brace or reinforce ducts where necessary to overcome vibration, buckling or breathing.

~~C.~~D. Thermometers: Install in outdoor, return, and supply air ductwork at air handling units and elsewhere as indicated.

3.2 METAL DUCT INSTALLATION

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A. Drawing plans, schematics and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations and arrangements were used to size the ducts and calculate friction loss for sizing of fans. Install duct systems as indicated unless deviations to the layout are approved on Shop Drawings and Coordination Drawings.

B. Construct ducts true to indicated dimensions straight and smooth on the inside with neatly finished airtight joints.

C. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

D. Construct the sides of a section of duct of gage specified for its maximum dimension.

E. Clean and point welds and threads with zinc dust paint.

F. Install ducts in maximum practical lengths.

G. Install ducts with fewest possible joints.

H. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

I. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

J. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

K. Install ducts with a clearance of 6 inches, plus allowance for insulation thickness.

~~K.~~L. Connect terminal units to supply ducts with a minimum three duct diameter length duct with the last 1-foot as sheet metal equal to terminal unit's inlet size. Do not use insulated flexible ducts to change directions. Do not exceed 5 feet of insulated flexible duct.

~~L.~~M. Connect diffusers to ducts with maximum 60 inch length of insulated flexible duct clamped or strapped in place.

~~M.~~N. Connect insulated flexible ducts to metal ducts with adhesive plus sheet metal screws.

~~N.~~O. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

P. Where rigid board insulation is applied, do not use cross break or bead construction.

Q. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

S. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

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~~O.~~T. Seal seams and joints in outdoor ductwork with sealing compound protected by weather resistant tape.

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3.3 INSULATED FLEXIBLE DUCT

A. Provide on runout to inlet of air terminal unit. Insulated flexible duct shall be located upstream of required 1-foot straight length of sheet metal duct section at air terminal unit inlet.

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~~A.~~B. Provide on connection to round neck supply air ceiling diffusers.

~~B.~~C. Runs of insulated flexible duct shall not to exceed five feet in length.

~~C.~~D. Install without kinks and compressions. Support duct with minimum 1-inch wide band hangers to avoid sagging. Supports shall conform to SMACNA Fig. 3-10.

~~D.~~E. Provide bends with throat radius not less than outside diameter of insulated flexible duct.

~~E.~~F. Provide duct elbow support at locations where an elbow connection is provided.

~~F.~~G. Seal insulation at ends and other openings to maintain continuity of vapor barrier. Secure joints with pressure sensitive tape and clamps. Insert high-density sections of insulation between vapor barriers and duct under clamps to maintain insulation thickness.

~~G.~~H. Install in accordance with manufacturer's recommendations.

3.4 DUCT SEALING

A. Follow manufacturer's recommendations. If necessary to achieve an airtight joint, additionally apply duct tape to wet sealant compatible with the sealer used. Allow adequate curing time before pressurizing system.

B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Supply and Return Air Rectangular and Round Ducts in Pressure Classes 2-inch w.g. and Lower: Seal Class B.
~~2.~~3. Outdoor Air Ducts: Seal Class A.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

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1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet connections.

3.7 TESTING

A. Perform tests and inspections.

B. Disassemble, reassemble and seal segments of system to accommodate leakage testing and for compliance with test requirements.

C. Test for leaks before applying external insulation.

D. Test 2-inch w.g. and higher pressure (minus 2 inches and greater negative pressure) rated ductwork for leaks.

~~D.~~E. Test setup and procedure shall be generally in accordance with SMACNA HVAC Air Duct Leakage Test Manual, First Edition, 1985, with the following exceptions:

1. Test each duct section at rated pressure.

~~E.~~F. Seal leaks and openings and retest after sealer has cured.

~~F.~~G. After completing successful testing of a duct section, demonstrate duct tightness to Contracting Officer's Representative (COR) by repeating test.

~~G.~~H. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by COR, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

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a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

H. Duct system will be considered defective if it does not pass tests and inspections.

I. Prepare test and inspection reports.

3.7 DUCT CLEANING

A. Clean new and existing duct system(s) within the renovated area of work before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated ~~or lined~~ duct. Patch insulation ~~and liner~~ as recommended by ~~duct liner~~ manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Clean the following components by removing surface contaminants and deposits: ~~Air outlets and inlets (grilles and diffusers)~~.

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, filters and filter sections, and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

~~C.~~6. Supply-air ducts, dampers, actuators, and turning vanes.

D. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Provide drainage and cleanup for wash-down procedures.

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Airflow monitors, smoke detector installation, sound attenuators, duct access doors, air flow control devices, and ~~A~~accessories for balancing air flow.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 - Testing, Adjusting, and Balancing

D. Section 23 07 00 - Mechanical Insulation

~~D.~~E. Section 23 29 23 ~~-~~ HVAC Instrumentation and Controls

~~E.~~F. Section 23 31 13 - Ductwork

1.3 QUALITY ASSURANCE

A. For details not specified, such as hangers, dampers, acceptable materials, material thicknesses and duct construction methods, the following reference applies:

Sheet Metal and Air Conditioning Contractors National Association "HVAC Duct Construction Standards, Metal and Flexible," Third Edition, 2005 referred to herein as SMACNA-HVAC.

B. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discoloration and other imperfections.

C. Comply with NFPA 90A.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Statement indicating compliance with SMACNA standards and specified system pressure ratings.

C. Manufacturer's technical product data, installation instructions and accessories for the following:

Flexible Connections
Instrument Test Holes
Manual Volume Dampers
Duct Mounted Smoke Detectors
Duct-Mounted Access Doors
Air Flow Monitors
~~Sound Attenuator~~

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D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

B. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less.

2.2 FLEXIBLE CONNECTORS

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A. Provide 6-inch wide neoprene impregnated glass fabric collars between fans and ducts or casings, where indicated on drawings, and wherever ducts cross building expansion joints.

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B. Collars shall have flame retardant or noncombustible fabrics to have flame spread index not over 25 and a smoke developed index not over 50.

C. Coatings and Adhesives: Comply with UL181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel.

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E. Indoor Location, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 degrees F.

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F. Outdoor Location, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

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1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
Service Temperature: Minus 50 to plus 250 degrees F.
3.

Manufacturers: C. L. Ward, Ductmate, Dyna Air, Ventfabrics, Ward Industries.

G.

~~2.2~~2.3 INSTRUMENT TEST HOLES

A. Cast iron or cast aluminum to suit duct material, including screw cap and gasket.

B. Locate where accessible in main or major branch ducts to permit measurement of fan air quantities according to ASHRAE Pitot tube method.

C. Locate holes on more than two sides of larger duct if required by available Pitot tube length.

D. Provide holes with 1-inch high Ventlok No. 699 instrument ports.

E. Size to allow insertion of pilot tube and other testing instruments and of length to suit duct insulation thickness

~~2.3~~2.4 MANUAL VOLUME DAMPERS

A. Manual Volume Dampers:

1. Type

   a. Type 1 - Standard.

2. Materials: Steel or Aluminum to match duct materials.

   a. Standard, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
~~3.~~
4. Frames:

   a. Frame: Hat-shaped.
   b. Mitered and welded corners for steel units.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.

6. Blade Axles: Galvanized steel, Stainless steel or Nonferrous metal.

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~~6.~~

7. Bearings:

   a. Oil-impregnated bronze; Oil-impregnated stainless-steel sleeve; or Stainless-steel sleeve.

8. Tie Bars and Brackets: Galvanized steel.

B. Pressure Rating 2 inch W.G. and Less: SMACNA-HVAC, 7-4 A, B, C, 12-inch maximum blade width no internal frame. Fig. 7-5, multi opposed blade larger than 12-inch duct height, 8-inch maximum blade width. Recess frame totally out of airstream. Limit stop penetration into airstream to 1/2-inch. Dampers less than 5 feet upstream of outlets, equivalent to Young Regulator No. 820.

C. Locate where accessible for adjusting after completion of work. Provide access panels where regulators are concealed. Provide damper regulators equal to "Ventlok" models listed.

1. Concealed: No. 641.
2. Manufacturers: Ventfabrics, Young Regulator.

D. Jackshaft:

1. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
2. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

F. Manufacturers: Air Balance, American Warming and Ventilating, Cesco, Greenheck, Nailor, Ruskin.

2.14 DUCT-MOUNTED ACCESS DOORS

A. Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

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3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.15 AIRFLOW MONITORS

A. Units shall be suitable for intended function and location in ductwork system or fan inlet.

B. Sensors or probes shall be calibrated for monitoring airflow and shall be factory tested.

C. Provide construction suitable for class, configuration, and size of ductwork or fan inlet to which it is applied.

D. Each station shall consist of sensors and matched transmitters and electronics required to produce a single analog output, linear to airflow or pressure.

E. Transmitter shall operate on 24-volt AC and shall include an alphanumeric LCD display in a NEMA-1 enclosure. All inputs and outputs shall be fused protected and isolated from the 24-volt AC power source. Transmitter accuracy shall be:

1. 0.25 percent for velocities less than 1000 fpm.

2. 0.5 percent for velocities 1000 fpm and greater.

F. Unit manufacturer shall coordinate requirements with the automatic control system subcontractor to perform the required sequence of operation.

G. Differential pressure transmitters shall have the ability to perform auto zeroing to adjust the signal to zero at predetermined intervals to eliminate signal drift due to thermal, electronic, and mechanical effects and shall maintain accuracy over the life of the equipment without the need for recalibration or adjustment.

H. The electronics shall operate and maintain specified accuracy between 40-120 degrees F and 0-95 percent relative humidity.

I. Static Pressure Sensing Station: Factory assembled unit with aluminum stainless steel air straightener and metallic static pressure sensing manifold, non-combustible sensing devices, internal piping, quick connect fittings, and flanged galvanized steel casing. The total accuracy to the building automation system, including sensing point averaging error and the sum of sensor and electronic errors shall not exceed plus or minus 3 percent of reading.

J. Air Flow Measuring Station

1. Type A- Duct-mounted Unit: Factory assembled unit with aluminum air straightener and metallic total and static pressure sensing manifolds, noncombustible sensing devices, internal piping, quick connect fittings, flanged galvanized steel casing. The total accuracy

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to the building automation system, including sensing point averaging error and the sum of sensor and electronic errors shall not exceed plus or minus 3 percent of reading. Applicable to ducts with velocities not less than 800 fpm at minimum airflow.

2. Type B – Fan-mounted Unit: Factory assembled unit with total and static pressure sensing manifold. The total accuracy to the building automation system, including sensing point averaging error and the sum of sensor and electronic errors shall not exceed plus or minus 3 percent of reading.

K. Outdoor Air Measurement and Monitor Controller: Air Monitor Corp. Volu-flo/OAM outdoor air monitor or approved equal. Factory assembled unit constructed of non-corrosive material with non-painted surfaces constructed of stainless steel or other non-corrosive material. Electronics shall be housed in NEMA 1 (Indoor) or 4 (outdoor) enclosure. The total accuracy shall be plus or minus 5 percent between 75-750 fpm and shall not be affected by wind gusts or moisture droplets. Unit shall provide control of outdoor air damper. Display shall be alphanumeric LCD. Measured airflow shall be continuously density corrected for ambient temperature and atmospheric pressure.

L. Airstream materials and casing shall match duct materials for systems installed.

M. Manufacturers: Air Monitor Corporation, Ebtron, Tek-Air.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized steel.

~~B.~~C. Flexible Connectors: Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

~~C.~~D. Instrument Test Holes

1. Install test holes at fan inlets and outlets and elsewhere as indicated.
2. Install test holes where required for testing and balancing purposes.

~~D.~~E. Manual Volume Dampers:

1. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts and elsewhere as indicated.
2. Install a minimum of two duct widths from air device outlet or inlet.
3. Install steel volume dampers in steel ducts.
4. Set dampers to fully open position before testing, adjusting, and balancing.
5. Mark balanced position.
6. Elevate dial to face of insulation.

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G. Duct-Mounted Access Doors: Install airtight duct access doors in casings, plenums, and ducts to allow for inspecting, adjusting, and maintaining accessories and equipment.

1. Install duct-mounted access doors in the following locations:
   a. On both sides of duct coils.
   b. Downstream from manual volume dampers, backdraft dampers, and equipment.
   c. Adjacent to and close enough to fire or smoke dampers, providing access to reset or reinstall fusible links.
      1) Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   d. At casings and plenums.
   e. Upstream and downstream from duct mounted filters.
   f. At drain pans and seals.
2. Install access doors with swing against duct static pressure.
3. Install on sides of ducts where adequate clearance is available, otherwise locate on bottom of ducts, except kitchen exhaust ducts.
4. Install the following sizes for duct-mounting, rectangular access doors:
   a. One-Hand or Inspection Access: 8 by 5 inches.
   b. Two-Hand Access: 12 by 6 inches.
   c. Head and Hand Access: 18 by 10 inches.
   d. Head and Shoulders Access: 21 by 14 inches.
   e. Body Access: 25 by 14 inches.
   f. Body Plus Ladder Access: 25 by 17 inches.
5. Install the following sizes for duct-mounting, round access doors:
   a. One-Hand or Inspection Access: 8 inches in diameter.
   b. Two-Hand Access: 10 inches in diameter.
   c. Head and Hand Access: 12 inches in diameter.
   d. Head and Shoulders Access: 18 inches in diameter.
   e. Body Access: 24 inches in diameter.
6. Install the following sizes for duct-mounting, pressure relief access doors:
   a. One-Hand or Inspection Access: 7 inches in diameter.
   b. Two-Hand Access: 10 inches in diameter.
   c. Head and Hand Access: 13 inches in diameter.
   d. Head and Shoulders Access: 19 inches in diameter.

H. Airflow Monitors

1. Install static pressure sensing stations in ductwork at an appropriate location, coordinate with owner and COR. Locate upstream and downstream of fittings and components as recommended by manufacturer.

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2. Install Type A airflow measuring stations in ductwork where shown on drawings. Locate upstream and downstream of fittings and components as recommended by manufacturer.
3. Install Type B airflow measuring stations in fan inlet where shown on drawings. Install in accordance with manufacturer's recommendations.
4. Install outdoor air measurement and monitor controller at an appropriate location, coordinate with owner and COR. Install in accordance with manufacturer's recommendations.
5. Identify each unit with permanent label listing model number, size, area, and capacity.
6. Provide wiring between the sensor and the electronics. Use UL plenum rated cable.

~~6.~~

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3.2 TESTING

~~A.~~ Operate dampers to verify full range of movement.

~~A.~~

B. Inspect locations of access doors and verify that purpose of access door can be performed.

C. Inspect turning vanes for proper and secure installation.

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SECTION 23 36 16 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Air control and distribution devices, which provide control of air volume or air temperature. Units shall be of the type and quantity indicated, complete with components as specified and as indicated on the drawings.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 - Testing, Adjusting and Balancing

D. Section 23 09 23 – HVAC Instrumentation and Controls

E. Section 23 31 13 - Ductwork

F. Section 23 33 00 - Air Duct Accessories

G. Section 23 37 13 - Air Inlets and Outlets

H. Section 23 70 20 - Packaged Rooftop Units

I. Section 23 81 26- Split System Air Conditioner

J. Division 26 - Electrical

1.3 QUALITY ASSURANCE

A. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.

B. Test and rate units in accordance with the current edition of ARI Standards 880 and 885. Submit certified performance data, including pressure requirements, leakage and tightness, volume control, and sound power ratings for Engineer’s review.

C. Units shall be compatible and coordinated with indicated control sequences and with controls of the automatic control subcontractor.

D. Pneumatic tubing shall be UL listed fire retardant (FR) type suitable for air plenum ceiling application.

E. Each terminal unit shall have label and instructions for location, size and scheduled cfm. Provide flow curves on each terminal for field balancing.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Manufacturer's technical product data, including installation instructions, performance data, accessories, supports, fittings, finishes, construction details, and dimensions of components:

Single Duct Air Conditioning Terminal Units

C. Manufacturer's sound power levels for air terminal units.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Provide all material and equipment specified in this section with performance requirements as stated herein or on the drawings.

B. Except where specified, equipment size, capacities, minimum and maximum cfm settings, and other performance requirements are scheduled on the drawings.

C. With 1.5-inch w.g. pressure drop across the unit when delivering scheduled air volume, sound power levels in decibels in the second through seventh octave band at the unit discharge (less the indicated discharge allowance which includes room effect duct attenuation), and the sound power levels from unit casing radiation (less the indicated radiation allowance, which includes ceiling plenum, ceiling, and room effect) shall not exceed the NC level listed below.

APPLICATION	NC	DISCHARGE ALLOWANCE	RADIATION ALLOWANCE
Classrooms	35	3	8
Hall	35	5	8
Offices	30	4	8

Enclose units which cannot meet the specified sound power ratings for casing radiation with 2-inch thick wrap of 3 pounds per cubic foot density fiber glass insulation and a jacket of lead, leaded or loaded vinyl with surface weight as required to meet the specified sound power levels. Secure the entire wrap to the box with weld nail pins. Seal all joints of the exterior jacket air tight. Alternate methods of enclosure will be considered provided independent laboratory test data rating the enclosed unit in accordance with AHRI Standard 880 is submitted. Provide access as required. Provide discharge air sound attenuators for boxes which cannot meet specified unit sound power ratings.

D. Casing: Completely insulated internally with erosion-protected insulation meeting NFPA 90A and UL 181 requirements. Leakage shall not exceed 1 percent of nominal rated volume.

E. Inlet Air Damper: Leakage when fully closed shall not exceed 2 percent of nominal rated volume.

F. Electric Coil: Shall conform to the requirements of approved manufacturer and installation.
   1. Proportional, modulating electric coils shall be supplied and installed on the terminal by the terminal manufacturer.
   2. Coils shall be ETL listed.
   3. Coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge to prevent damage to elements during shipping and installation.
   4. Elements shall be 80/20 nickel chrome, supported by ceramic isolators staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step.
   5. Integral control panel shall be housed in a NEMA 1 enclosure with hinged access door for access to all controls and safety devices.
   6. Electric coils shall contain a primary automatic reset thermal cutout, a secondary manual reset thermal cutout, proportional electronic airflow sensor for proof of flow, and line terminal block.
   7. The proportional electronic airflow sensor shall be totally independent of the duct static pressure and shall adjust the heater capacity according to the available airflow.
   8. The heaters shall deliver maximum heating when needed with normal minimum airflow, reduce heating with lower than minimum airflow and stop heating with no airflow.
   9. Unit shall include an integral door interlock type disconnect switch which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable.
   10. All individual components shall be UL listed or recognized.
   11. Heaters shall be equipped with a proportional SCR controller to modulate the heater load according to the temperature control signal. The electronic controller shall be compatible with the following input signals:
      a. Variable voltage signal 0-10 VDC.
      b. Pulse width modulation AC or DC.

G. Factory installed access panel located in underside of unit for access to control damper and upstream side of coil.

PART 2 - PRODUCTS

2.1 SINGLE DUCT AIR CONDITIONING TERMINAL UNIT - ELECTRONIC

A. Type

   1. Equivalent to Titus DESV direct digital, pressure independent units with airflow sensor located in the inlet and electric reheat coil on box discharge. The airflow sensor shall compensate for all inlet conditions. Drawing Designation: VAV.
   2. Airflow Sensor and Volume Regulator: Compatible with the control contractor’s direct digital controller for instantaneous compensation for system static pressure fluctuations, to maintain within 5 percent of set point air volume with inlet static pressures ranging from minimum for adequate air flow to 6 inches.

3. Minimum pressure drop for adequate airflow including attenuator, where required, coil and terminal unit shall be 0.5-inch w.g. maximum at specified airflow.

B. Velocity sensor shall be by terminal box manufacturer and factory mounted unless the control contractor requires an electronic flow sensor. If an electronic flow sensor is required, it shall be obtained from the control contractor and factory mounted.

C. Direct digital pressure-independent controller unit shall be obtained from the control contractor and factory mounted by terminal unit manufacturer in a NEMA 1 enclosure with a 120/24 volt transformer and a 120 volt disconnect switch.

D. Obtain necessary mounting and installation instructions for the electronic controller and, where required, the flow sensor from the control contractor.

E. Flow measuring taps with caps shall be provided on tubing between velocity sensor and controller.

F. Manufacturers: Anemostat, Carnes, Environmental Technologies, Krueger, Nailor, Price, Titus, Trane, Tuttle & Bailey.

PART 3 - EXECUTION

3.1 AIR CONDITIONING TERMINAL UNITS

A. Locate units for a minimum of 12 inches clear unobstructed access to unit access panel, and control actuator.

B. Install duct transition and sound attenuator at unit discharge.

C. Connect power wiring to electric heating coil in accordance with Division 26. Coordinate with Electrical Contractor.

D. Coordinate with automatic control manufacturer.

E. Provide insulated flexible duct connection for terminal unit runout duct specified under Section 23 31 13, “Ductwork.” Maximum length of 5 feet. Bends shall be not less than one duct diameter centerline radius.

F. Provide minimum three duct diameters between duct take-off and box inlet with one-foot minimum of straight sheet metal duct connection to inlet of terminal unit equal to the unit size.

G. For all terminal units requiring a sound attenuator, provide a duct transition between terminal unit or reheat coil and sound attenuator and between attenuator and the duct size indicated on drawings.

H. For all terminal units without a sound attenuator, provide a duct transition between terminal unit or reheat coil and the duct size indicated on drawings.

I. Maintain required clearance in front of electric heater control panel in accordance with NFPA 70 (National Electrical Code).

END OF SECTION 23 36 16

SECTION 23 37 13 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Air distribution diffusers and registers, with application for air outlets and inlets.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 - Testing, Adjusting, and Balancing

D. Section 23 31 13 - Ductwork

1.3 QUALITY ASSURANCE

Diffusers and Registers: Test and rate in accordance with ASHRAE Standard 70 and AHRI Standard 890.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 230500, “Basic Mechanical Materials and Methods”.

B. Statement indicating compliance with ASHRAE and AHRI standards.

C. Manufacturer's technical product data, installation instructions and accessories:

Diffusers
Registers

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Coordinate with ceiling, floor, and wall construction and materials.

B. Coordinate with lights, speakers, sprinklers, and other ceiling elements.

PART 2 - PRODUCTS

2.1 DIFFUSERS

A. Factory-fabricated steel or aluminum with fixed or adjustable air discharge pattern as indicated.

B. Unless otherwise indicated, provide removable internal parts including the velocity equalizing device.

2.2 REGISTERS

Factory-fabricated steel or aluminum without face-operated, opposed-blade, volume-control damper.

2.3 OUTLET/INLET TYPE

Air delivery, performance, noise level, function, and type suitable for the duty intended and equal in these respects to the following:

A. Supply Registers:

1. Type D-1: Titus S300 FL spiral duct-mounted supply register vertical split face. The deflection blades shall be available parallel to the short dimension of the supply register. All supply registers shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter. All supply r shall be constructed with a 1 3/8-inch wide border. Blades shall be constructed of heavy duty extruded aluminum and shall be spaced 3/4-inch apart. Blades shall be individually adjustable. Air scoop damper/extractor shall be constructed of heavy duty aluminum. Finish shall be as selected by Architect.

2. Type D-4: Titus 300 RL vertical split face, double deflection steel register with individually adjustable front and rear vanes set on 3/4-inch centers. Unit shall be complete with , plaster frame, continuous gasket, and phosphate coating and finish as selected by Architect.

B. Square and Rectangular Louvered Faced Ceiling Diffusers:

1. Type D-2: Titus TMRA round ceiling diffuser with fully adjustable core one-piece flange, positive latch and linkage arrangement to permit removal of core, continuous gasket and anti-smudge ring. Constructed of steel with finish as selected by Architect.

2. Type D-3: Titus TMS, 24 by 24 inches square face, round neck ceiling mounted steel diffuser with 4-way blow pattern. Removable inner core and 360 degree air pattern held tight to the ceiling, and complete with continuous gasket, finish as selected by the Architect. Frame suitable for mounting in the type of ceiling in which the diffuser is installed. One-piece, stamped cone construction.

C. Square and Rectangular Perforated Faced Return or Exhaust Air Registers:

Type R-1: Titus PAR square or rectangular-perforated face, ceiling mounted steel return or exhaust air grille, as indicated. Complete with concealed hinges, continuous gasket, and finish as selected by architect. Frame suitable for mounting in the type of ceiling in which the diffuser is installed.

D. Return Registers:

Type R-2: Titus 350 RL vertical split face, steel register with 35 degree stationary deflecting vanes set on 3/4-inch centers. Complete with plaster frame, continuous gasket, and phosphate coating and baked white enamel finish.

E. Manufacturers:

1. All Types: Anemostat, Carnes, Krueger, Metalair, Nailor, Price, Titus, Tuttle & Bailey.

PART 3 - EXECUTION

3.1 DIFFUSERS AND REGISTERS

A. Provide diffusers and grilles to distribute the quantity of air specified evenly over the intended space without causing dead spots or air velocities exceeding 50 fpm in the occupied zone.

B. Coordinate location with lighting and ceiling pattern. Perform minor duct modifications to suit.

C. Add internal baffles where necessary to avoid drafts due to air impingement on nearby partitions, columns, etc.

D. The installing contractor shall examine all openings, mechanical and electrical work, and adjoining and adjacent construction to receive diffusers and plaster frames prior to commencing this work.

E. The installing contractor shall field verify that the rough hard ceiling opening dimensions are as indicated within manufacturer's submittals. Hard ceiling conditions shall be plumb and level and ready to receive the plaster frames or framing sections. Openings not acceptable for installation shall be corrected by the appropriate contractor until conditions are satisfactory to installing contractor.

END OF SECTION 23 37 13

SECTION 23 70 20 – PACKAGED ROOFTOP UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Heat generating and refrigerant equipment, heat transfer equipment, air handling equipment, air distribution devices and associated integral supports, accessories, piping, motors and integral controls.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 48 - Mechanical Sound and Vibration Controls

D. Section 23 05 93 - Testing, Adjusting, and Balancing

E. Section 23 09 27 - HVAC Instrumentation and Controls

F. Section 23 20 00 - Building Services Piping

G. Section 23 31 13 - Ductwork

H. Section 233300 - Air Duct Accessories

I. Division 26 - Electrical

1.3 QUALITY ASSURANCE

A. Equipment specified shall meet all requirements of the 2015 International Energy Conservation Code (IECC)

B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.

C. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360.

D. Unit shall be certified in accordance with UL Standard 1995.

E. Unit and refrigeration system shall comply with the 2015 International Mechanical Code.

F. Unit shall be certified in accordance with ANSI Z21.47b and ANSI Z83.8 Safety Standard Gas-Fired Furnaces.

G. Unit Energy Efficiency Ratio (EER) or Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater than prescribed by the 2015 IECC.

H. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.4 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. Filters: One set for each air-handling unit.
2. Gaskets: One set for each access door.
3. Fan Belts: One set for each air-handling unit fan.

1.5 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods”.

B. Manufacturer's technical product data, including installation instructions, performance data, accessories, supports, fittings, finishes, construction details, operating and shipping weights, fan performance, filter information, electrical characteristics, connection requirements, and dimensions of components:

Packaged Rooftop Units (RTU)

C. Operation and Maintenance Manual materials.

D. Sound power levels for radiated and discharge noise.

E. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details.

1. Computer generated fan curves for each fan shall be submitted with specific design operation point noted.
2. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.6 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.7 PROJECT CONDITIONS

A. Provide all material and equipment specified in this section with performance requirements as stated herein or on the drawings.

B. Except where specified, equipment and system capacities and performance requirements are scheduled on the drawings.

1.8 WARRANTY

Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

PART 2 - PRODUCTS

2.1 PACKAGED ROOFTOP UNIT

A. Drawing Designation: RTU-3

B. Basis of Design: Daiken Rebel.

C. GENERAL DESCRIPTION

1. Furnish as shown on plans, unit performance and electrical characteristics shall be per the schedule on drawings.
2. Configuration: Fabricate as detailed on prints and drawings:

    a. Return plenum / economizer section
    b. Return fan section
    c. Filter section
    d. Cooling coil section
    e. Supply fan section
    f. Gas heating section
    g. Condensing unit section

3. The complete unit shall be cETLus listed.
4. The unit shall be ASHRAE 90.1 compliant and labeled.
5. Each unit shall be specifically designed for outdoor application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with Refrigerant and oil.
6. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
7. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
8. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

9. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

D. CABINET, CASING, AND FRAME

1. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 2-inch thick with an R-value of 13.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
2. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16-inch at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.
3. Service doors shall be provided on the fan sections, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.
4. The unit base shall overhang the mounting curb for positive water runoff and shall seat on the mounting curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

E. OUTDOOR/RETURN AIR SECTION

1. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outdoor and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1-inch differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.
2. Economizer assembly Fault Detection and Diagnostics (FDD) shall be 90.1, IECC, and California Title 24 compliant. MicroTech III controls shall display a warning, and write a

warning to the BAS, if the economizer malfunctions in accordance with 90.1, IECC, and Title 24 specifications.

F. EXHAUST FAN

1. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.
2. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
3. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

G. FILTERS

1. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 4-inch final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2-inch MERV 8 filters.

H. COOLING COIL

1. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.
2. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.
3. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.
4. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.
5. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8-inch per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

I. SUPPLY FAN

1. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate

and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

2. All fan assemblies shall employ solid steel fan shafts. Heavy-duty pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide a L-50 life at 250,000 hours. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar and mounted on 1-inch spring isolators.
3. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.
4. Supply fan and motor assembly combinations larger than 8 hp or 22-inch diameter shall be internally isolated on 1-inch deflection, spring isolators and include removable shipping tie downs.
5. The fan motor shall be a totally enclosed EC motor that is speed controlled by the air handling unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.
6. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

J. VARIABLE AIR VOLUME CONTROL

1. An electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.
2. The unit manufacturer shall install all power and control wiring.
3. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

K. HEATING SECTION

1. The air handling unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.
2. The module shall be complete with furnace controller and control valve capable of 12:1 modulating operation.
3. The heat exchanger tubes shall be constructed of stainless steel.
4. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.
5. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.
6. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

L. INTEGRAL CONDENSING SECTION

1. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.
2. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 0~120 degrees F. Mechanical cooling shall be provided to 0 degrees F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
3. Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 25~120 degrees F. Mechanical cooling shall be provided to 25 degrees F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.
4. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite material.
5. The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and low oil safety protection. Digital scroll compressors are not acceptable due to noise and efficiency.
6. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.
7. Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.
8. Each circuit shall be dehydrated and factory charged with Refrigerant and oil.

M. ELECTRICAL

1. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

2. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

N. CONTROLS

1. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.
2. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.
3. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outdoor air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.
4. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.
5. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to ensure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.
6. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

    a. Return air temperature.
    b. Discharge air temperature.
    c. Outdoor air temperature.
    d. Space air temperature.
    e. Outdoor enthalpy, high/low.
    f. Compressor suction temperature and pressure
    g. Compressor head pressure and temperature
    h. Expansion valve position
    i. Condenser fan speed
    j. Inverter compressor speed

k. Dirty filter indication.
l. Airflow verification.
m. Cooling status.
n. Control temperature (Changeover).
o. VAV box output status.
p. Cooling status/capacity.
q. Unit status.
r. All time schedules.
s. Active alarms with time and date.
t. Previous alarms with time and date.
u. Optimal start
v. Supply fan and exhaust fan speed.
w. System operating hours.

1. Fan
2. Exhaust fan
3. Cooling
4. Individual compressor
5. Heating
6. Economizer
7. Tenant override

7. The user interaction with the keypad shall provide the following:

a. Controls mode
b. Off manual

1. Auto
2. Heat/Cool
3. Cool only
4. Heat only
5. Fan only

c. Occupancy mode

1. Auto
2. Occupied
3. Unoccupied
4. Tenant override

d. Unit operation changeover control

1. Return air temperature
2. Space temperature
3. Network signal

e. Cooling and heating change-over temperature with deadband
f. Cooling discharge air temperature (DAT)
g. Supply reset options

1. Return air temperature
2. Outdoor air temperature
3. Space temperature
4. Airflow (VAV)
5. Network signal
6. External (0-10 vdc)
7. External (0-20 mA)

h. Temperature alarm limits

1. High supply air temperature
2. Low supply air temperature
3. High return air temperature

i. Lockout control for compressors.
j. Compressor interstage timers
k. Night setback and setup space temperature.
l. Building static pressure.
m. Economizer changeover

1. Enthalpy
2. Drybulb temperature

n. Currently time and date
o. Tenant override time
p. Occupied/unoccupied time schedule
q. One event schedule
r. Holiday dates and duration
s. Adjustable set points
t. Service mode

1. Timers normal (all time delays normal)
2. Timers fast (all time delays 20 sec)

8. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:

a. Zone sensor with tenant override switch
b. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

9. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:

    a. Airflow
    b. Outside air temperature
    c. Space temperature
    d. Return air temperature
    e. External signal of 1-5 vdc
    f. External signal of 0-20 mA
    g. Network signal

O. MOUNTING CURB

1. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof prior to unit shipment. The curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14 inches high and include a nominal 2 by inch" wood nailing strip. Gasket shall be provided for field mounting between the unit base and mounting curb.

P. Manufacturers: AAON, Daikin, Trane, Carrier.

PART 3 – EXECUTION

3.1 AIR HANDLING UNITS

A. Openings in panels where piping, drives, etc., pass through panels, provide sealed sleeves. Caulk annular space between service lines and sleeves.

B. Mount on curb as indicated.

C. Construct field joints in accordance with manufacturer's recommendations. Provide continuous gaskets and caulk to ensure air and water tightness.

D. Check all seams and seals around coils and other components for leaks that may have developed in shipment and handling. Seal all leaks airtight in accordance with manufacturer's instructions and recommendations.

E. Locate as indicated. Level unit.

F. Maintain manufacturer’s recommended clearances for service and maintenance.

G. Install piping adjacent to unit to allow service and maintenance.

H. Connect wiring in accordance with Division 26.

I. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

END OF SECTION 23 70 20

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 48 - Mechanical Sound and Vibration Control

D. Section 23 05 93 – Testing, Adjusting, and Balancing

E. Section 23 09 23 - HVAC Instrumentation and Controls

F. Section 23 20 00 - Building Services Piping

G. Section 23 31 13 – Ductwork

H. Section 23 33 00 – Air Duct Accessories

I. Division 26 - Electrical

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. 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.

D. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with 2015 International Mechanical Code.

2.
3. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

E. ASHRAE/IES Compliance: Applicable requirements in the 2015 International Energy Conservation Code (IECC).

1.4 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. Filters: One set for each air-handling unit.
2. Gaskets: One set for each access door.
3. Fan Belts: One set for each air-handling unit fan.

1.5 COORDINATION

Coordinate sizes and locations of equipment supports with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five years from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNIT

A. Drawing Designation: AHU-4.

B. Basis of Design: Daikin Vision.

C. Unit Construction:

1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.

a. The inner liner shall be constructed of G90 galvanized steel.

b. The outer panel shall be constructed of G90 galvanized steel.
c. The floor plate shall be constructed as specified for the inner liner.
d. Unit will be furnished with solid inner liners.

3. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
4. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5" w.c. in positive pressure sections and -6" w.c. in negative pressure sections.
5. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
6. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
7. A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035. The following calculation shall determine the required height of the baserail to allow for adequate drainage. Use the largest pressure to determine base rail height. [(Negative)(Positive) static pressure (in)] (2) + 4" = required baserail height. Should the unit baserail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.
8. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3 inches above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2-inch thickness of insulation under drain pan.

D. Fan Assemblies

1. Acceptable fan assembly shall be a double width, double inlet, class II, belt-drive type housed airfoil fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Copper lubrication lines shall be provided and extend from the bearings and attached with grease fittings to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field. Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door.
2. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2-inch deflection spring vibration type isolators inside cabinetry.

E. Bearings, Shafts, and Drives

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be designed for service with an L-50 life of 200,000 hours and shall be a heavy duty pillow block, self-aligning, grease-lubricated ball or spherical roller bearing type.
2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
3. V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor minimum shall be 1.1 S.F. for 1/4 HP – 7.5 HP, 1.3 S.F. for 10 HP and larger, calculated based on fan brake horsepower.

F. ELECTRICAL

1. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1750 RPM, single speed, 208V / 60HZ / 3PH.
2. The air handler(s) shall be ETL and listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
3. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.

G. COOLING AND HEATING COILS

1. Certification: Acceptable refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

2. Direct expansion refrigerant cooling coil.

    a. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 3 inches beyond unit casing for ease of installation. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor shall supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
    b. Sweat type copper suction headers shall be provided.
    c. Fins shall have a minimum thickness of 0.0075-inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to

secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

d. Coil tubes shall be 5/8-inch OD seamless copper, 0.020-inch nominal tube wall thickness, expanded into fins on 1 1/2-inch centers, brazed at joints.

e. Sweat type copper suction connections located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counterflow manner for either single circuit, row, face, interlaced, or interlaced face split capacity reduction as shown on unit schedule. Pressure type liquid distributors used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.

f. Coil casing shall be a formed channel frame of galvanized steel.

H. FILTERS

1. Furnish flat panel filter section with 2-inch pleated MERV 8 filter. Provide side loading and removal of filters.
2. Filter media shall be UL 900 listed, Class I or Class II.

2.2 REMOTE CONDENSING UNIT

A. Air Cooled Condenser

1. The condensing section shall be open on the sides and bottom to provide access and to allow airflow through the coils. Condenser coils shall be constructed with 3/8-inch copper tubing mechanically bonded to aluminum fins for maximum heat transfer. Each condenser coil shall be factory leak tested with high-pressure air under water.
2. Condenser fans shall be direct drive, propeller type designed for low tip speed, vertical air discharge, and include service guards. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motor shall be direct drive, single phase, permanently lubricated motors with inherent thermal overload.
3. Unit shall be rated to operate down to 55 degrees F low ambient standard, and include low ambient kit for operation down to 0 degrees F.
4. Condenser fan motor shall be direct drive, single phase permanently lubricated motors with inherent thermal overload.
5. Unit shall be complete with liquid and suction line isolation valves.

B. Scroll Compressors

1. Unit shall have heavy-duty scroll compressor(s).
2. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission

    a. Capped connections shall be external to the unit providing for field connection of refrigerant piping.

    b. Unit shall have a liquid and suction line service valve.

C. CONTROLS

1. Unit shall be equipped with a 24V terminal strip for field supplied and installed controls.

D. ELECTRICAL

1. All wiring shall comply with UL requirements. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point terminal block for main power connection. A terminal board shall be provided for low voltage control wiring.

2.3 MANUFACTURERS

Including but not limited to: Daikin, Carrier, York, Trane/Mitsubishi.

PART 3 – EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Installation must comply with installation manual. It is recommended the system be installed by a contractor/dealer who has been through manufacturer training programs.

B. Openings in panels where piping, drives, etc., pass through panels, provide sealed sleeves. Caulk annular space between service lines and sleeves.

C. Mount on concrete pad as indicated.

D. Construct field joints in accordance with manufacturer's recommendations. Provide continuous gaskets and caulk to ensure air and water tightness.

E. Check all seams and seals around coils and other components for leaks that may have developed in shipment and handling. Seal all leaks airtight in accordance with manufacturer's instructions and recommendations.

F. Locate as indicated. Level unit.

G. Maintain manufacturer’s recommended clearances for service and maintenance.

H. Install piping adjacent to unit to allow service and maintenance.

I. Provide electrical interconnection between unit and split, remote condensing in accordance with the electrical sections of this specification.

J. Provide refrigerant piping between unit and split, remote condensing in accordance with the piping sections of the specification.

K. Connect wiring in accordance with Division 26.

L. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

END OF SECTION 23 81 26

SECTION 23 82 39 - UNIT HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Unit Heaters with electric-resistant heating coils and associated integral supports, accessories, piping, and motors.

1.2 RELATED DIVISIONS AND SECTIONS

A. Division 01 - General Requirements

B. Section 23 05 00 - Basic Mechanical Materials and Methods

C. Section 23 05 93 - Testing, Adjusting, and Balancing

D. Section 23 09 23 - HVAC Instrumentation and Controls

1.3 QUALITY ASSURANCE

A. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.

B. Comply with UL 2021.

C. Comply with AHRI 440.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00, “Basic Mechanical Materials and Methods.”

B. Manufacturer's technical product data, including installation instructions, performance data, accessories, supports, fittings, finishes, construction details, and dimensions of components:

Propeller Unit Heaters
Electric Wall Heater

C. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

D. Include details of anchorages and attachments to structure and to supported equipment.

E. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

F. Wiring Diagrams: Power, signal, and control wiring.

G. Color samples for selection by Architect and Owner for Type C units.

H. Operation and Maintenance Data: Include in emergency, operation and maintenance manuals.

I. Manufacturer's sound power levels for motorized equipment.

1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation.

1.6 PROJECT CONDITIONS

A. Provide all material and equipment specified in this section with performance requirements as stated herein or on the drawings.

B. Except where specified, equipment and system capacities and performance requirements are scheduled on the drawings.

PART 2 - PRODUCTS

2.1 GENERAL

Capacities as indicated on the drawings.

2.2 TYPE E - ELECTRIC WALL HEATER

A. Equal to BERKO Model FRC with the following:

1. Heating equipment shall automatic fan forced air heater. Heater shall be designed for wall recess or surface mounting. Heaters shall be UL Listed.
2. Heating element shall be non-glowing design consisting of a resistance wire enclosed in a steel sheath with steel plate fins copper brazed.
3. Fan shall be five-bladed aluminum construction. Fan motor shall be totally enclosed.
4. Fan control shall be bi-metallic, snap action type and shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and unit the heating element is cool.
5. The tamper-proof thermostat shall be bi-metallic, snap-action type with enclosed contacts. It shall be completely concealed behind the front cover.
6. A manual –reset thermal cutout shall be built into the system to shut off the heater in the event of overheating.
7. A double-pole, single throw on/off switch shall be mounted on the back box for positive disconnect of power supply.
8. The front panel shall be bar grille type and shall be constructed of 16-gauge cold-rolled steel, welded into a uniform grille to direct air toward floor.

B. Manufacturers: Berko, Merkel, Reznor, Vulcan.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install and wire unit heaters in accordance with manufacturer's recommendations and applicable national and local Code. Coordinate with Electrical Contractor.

B. Install unit heaters to comply with NFPA 90A.

C. Install unit heaters level and plumb.

D. Secure electrical wall heaters to wall.

3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 23 82 39

SECTION 26 00 50 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.

1.2 DESCRIPTION OF WORK

A. Requirements of this Section are applicable to work in Divisions 26, 27 and 28.

B. Contract Documents

1. Contract drawings for electrical work are diagrammatic, intended to convey scope and general arrangement.
2. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.
3. Correct faulty work due to resolving discrepancies without proper approval.
4. Specifications establish quality of materials, equipment, workmanship and methods of construction.
5. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

C. Scope

1. Furnish and install the electrical work complete and ready for satisfactory service.

D. Definitions: The following are definitions of terms and expressions used in Divisions 26, 27 and 28.

1. “Accessible” – Capable of being removed or exposed without damaging the building or structure or finish or not permanently closed in by other equipment or by the structure or finish of the building.
2. “Approve” - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.
3. “Concealed” - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
4. “Directed” - directed by Engineer.
5. “Equal, equivalent” - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
6. “Exposed” - not concealed.
7. “Furnish” - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.
8. “Indicated” - indicated in Contract Documents.

9. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.
10. "Provide" - furnish and install, complete and ready for the intended use.
11. "Removable" - detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.
12. "Review" - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with regulations of NFPA, state, county, and municipal building ordinances, and other applicable codes and regulations.

B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

C. Material and Equipment Requirements

1. All materials and equipment shall be new and free from defects.
2. Use products of one manufacturer where two or more items of same kind of equipment are required.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.

D. Workmanship

1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate with Other Trades

   a. Coordinate work and cooperate with other trades to facilitate execution of work.
   b. Give full cooperation and coordination with other trades and furnish information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
   c. Furnish to other trades, as required, necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordinating adjacent work.

3. Accessible Equipment and Systems: Consider all materials and equipment installations and coordinate with the work of other trades to ensure equipment or systems are accessible for operations, maintenance, repairs, and replacement. Install materials and

equipment, including but not limited to, supports and electrical conduit, to permit complete unobstructed access to panelboards, transformers, and other items requiring access for inspection, maintenance, and operations. The installation of new equipment or materials which renders new or existing equipment inaccessible will be disapproved by the Engineer and shall be corrected by the Contractor.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment as follows:

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. So that connecting raceways, cables, wireways, cable trays, and busways will 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 specified in Division 7 Section "Penetration Firestopping."

1.5 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Division 01 for complete requirements.

B. Submit all products for a single specification section as a complete submittal. All products specified within a division shall be included, otherwise submittal will be returned as incomplete.

C. Clearly mark submittals to indicate actual intended products to be utilized. Marks may include highlighting, circling, boxing, checking, etc. Do not provide submittal data which lists multiple product’s options and features without clearly indicating which data applies to the products intended to be used on project.

D. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.

E. Call attention, in writing, to deviations from contract requirements.

F. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the Engineer and the shop drawing has been marked to indicate "No Exception Taken" or "Make Corrections Noted."

G. Use only final or corrected drawings and data for construction. This includes all Addendums, Architectural Supplemental Information (ASIs), and Change Bulletins.

H. The Engineer's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.

C. 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.

D. 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.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 FIRESTOPPING

Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Penetration Firestopping."

END OF SECTION 26 00 50

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Fire-alarm wire and cable.
4. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. 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. Encore Wire Corporation.
2. General Cable Technologies Corporation.
3. Okonite Company (The).
4. Service Wire Co.
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. 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. AFC Cable Systems; a part of Atkore International.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multi-circuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Steel, interlocked.

2.3 FIRE-ALARM WIRE AND CABLE

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. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Superior Essex Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. 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. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Hubbell Power Systems, Inc.
4. ILSCO.
5. NSi Industries LLC.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with standard barrels.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. 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.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRING

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 280528 "Pathways for Electronic Safety and Security."

1. Install plenum cable in environmental airspaces, including plenum ceilings.

2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
3. Signaling Line Circuits: Power-limited fire-alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 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-486B.

B. Make splices, terminations, 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 12 inches of slack.

D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078400 "Penetration Firestopping."

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding for systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. 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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. 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. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Thomas & Betts Corporation; A Member of the ABB Group

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16-inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL 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, 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.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

H. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

I. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

a. Material: Tin-plated aluminum.
b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, 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 except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING AND BONDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater and Heat-Tracing Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, or wiring closet.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Poles Supporting Outdoor Lighting Fixtures: Install an insulated equipment grounding conductor with branch-circuit conductors.

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. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Grounding and bonding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel 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. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. 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, stainless 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. Manufacturers: Subject to compliance with requirements, provide products by one of 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 or malleable-iron, 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.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in 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 two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this

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 New Concrete: Bolt to concrete inserts.

2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
5. 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.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

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 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.

1.2 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. FMC: Comply with UL 1; zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC WIREWAYS, CONDUITS, TUBING, AND FITTINGS

A. Nonmetallic wireways, conduits, tubing, and fittings are not allowed."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Mono-Systems, Inc.

4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, 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. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

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. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.

15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep for double gang box. and 4 inches by 2-1/8 inches by 2-1/8 inches deep for single gang box.

I. Gangable boxes are allowed.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

K. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: IMC. Raceway locations include the following:

   a. Mechanical rooms.
   b. Gymnasiums

4. Concealed in Ceilings and Interior Walls and Partitions: EMT
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X stainless steel damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter.

B. Keep raceways at least 12 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.

R. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways 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.

S. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 26 05 00 "Common Work Results for Electrical."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sleeves and sleeve seals for electrical raceways and cabling.

B. Related Sections include the following:

1. Division 26 Section "Raceways and Boxes for Electrical Systems" for conduits, tubing, fittings, boxes, enclosures, and cabinets.

1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. HDPE: High Density Polyethylene.

C. NECA: National Electrical Contractors Association.

D. NEMA: National Electrical Manufacturers Association.

1.3 SUBMITTALS

A. Product Data: For specified products.

B. Source quality-control test reports.

C. Field Quality 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 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 26 Section "Common Work Results for Electrical."

2.2 SLEEVE SEALS

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. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. 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.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 26 Section "Common Work Results for Electrical."

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. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. 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.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 26 Section "Common Work Results for Electrical."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using 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.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in

annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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 POWER AND CONTROL RACEWAY 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 size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL 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 cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

2.3 CONDUCTOR 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. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

2.4 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 48 INCHES."
3. Arc Flash Hazard Warning: “WARNING – POTENTIAL ARC FLASH HAZARD – APPROPRIATE PPE AND TOOLS REQUIRED WHEN WORKING ON THIS EQUIPMENT.”

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one-piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify 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. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. 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.

B. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination pre-printed.

C. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tube with the conductor designation.

D. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Controls with external control power connections.
    b. Mechanical equipment.

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchboards.
    e. Distribution panels.
    f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Enclosed switches.
    h. Enclosed controllers.
    i. Variable-speed controllers.
    j. Contactors.

k. Remote controlled switches, dimmer modules, and control devices.
l. Monitoring and control equipment.
m. Battery inverter units.

END OF SECTION 26 05 53

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for commissioning the electrical system and its subsystems and equipment.

B. Related Sections include the following:

1. Section 01 91 13 "General Commissioning Requirements"

C. The following systems and/or equipment shall be commissioned.

1. Interior Lighting and associated controls.

1.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Agent (CA).

B. Attend construction phase controls coordination meeting.

C. Participate in lighting systems component maintenance orientation and inspection as directed by the CA.

D. Provide information requested by the CA for final commissioning documentation.

E. 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 AGENT'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual lighting systems, domestic hot water system, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Provide test data, inspection reports, and certificates in Systems Manual.

1.4 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
4. Certificate of readiness certifying that lighting systems, subsystems, equipment, and associated controls are ready for testing.
5. Test and inspection reports and certificates.
6. Corrective action documents.

1.5 SUBMITTALS

A. The following submittals are in addition to those specified in Section 01 91 13 "General Commissioning Requirements."

B. Testing Procedures: CA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CA shall certify that installation, prestart, and startup activities have been completed.

E. Test and Inspection Reports: CA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.

F. Corrective Action Documents: CA shall submit corrective action documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Prerequisites for Lighting Testing:

1. Certify that interior lighting systems and controls have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
2. Certify that lighting instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.
3. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
4. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, and unoccupied cycle).
5. Annotate checklist or data sheet when a deficiency is observed.
6. Verify proper responses of monitoring and control system controllers and sensors to include the following:

a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
b. Report deficiencies and prepare an issue log entry.

3.2 TESTING

A. Test interior lighting systems performance after test checklists for systems, subsystems, and equipment have been approved.

B. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

C. Scope of Electrical Contractor Testing:

1. Testing scope shall include interior lighting systems.

D. Detailed Testing Procedures: CA, with Electrical Contractor shall prepare detailed testing plans, procedures, and checklists for lighting systems, and equipment.

E. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the electrical system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

F. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
2. Include data sheets for each lighting systems to verify proper operation of the electrical systems, the system it serves, the service it provides, and its location. Provide space for testing personnel to sign off on each data sheet.
3. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION 26 08 00

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the following:

1. Ceiling-mounted occupancy sensors
2. Room controllers - Single and Dual Relays (power packs).
3. Ceiling-mounted indoor photosensor
4. Switch-box occupancy sensors.
5. Bi-Level (Dual Relay) Switch Box Occupancy Sensor.
6. Lighting Control Panel with Integral Timeclock
7. Outdoor Photocell

B. Related Requirements:

1. Section 26 08 00 “Commissioning of Electrical Systems.”
2. Section 26 27 26 "Wiring Devices" for wall-box dimmers and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED INDOOR OCCUPANCY SENSORS

A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Watt Stopper or comparable product by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lutron Electronics Co., Inc.
7. NSi Industries LLC; TORK Products.
8. Sensor Switch, Inc.
9. Square D; a brand of Schneider Electric.

B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- high ceiling.

2.2 SINGLE AND DUAL RELAY ROOM CONTROLLER (POWER PACKS)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Watt Stopper or comparable product by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co. Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.

B. General Requirements for Relays: Ceiling-mounted, solid-state for indoor applications.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Room Controller (Power Pack): Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
3. Mounting:

a. Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

2.3 CEILING MOUNTED INDOOR PHOTOSENSOR

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Watt Stopper or comparable product by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co. Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.

B. General Requirements for Photocell Controller:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Single-zone ceiling-mounted device that dims lighting as the ambient light level increases.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Mfg. Company Inc.
4. Lutron Electronics Co., Inc.
5. Sensor Switch, Inc.
6. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor (Tag OS):

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.

2. Sensing Technology: PIR.
3. Switch Type: SP
4. Voltage: Match the circuit voltage
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS, 0-10V DIMMING

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Watt Stopper or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Mfg. Company Inc.
4. Lutron Electronics Co. Inc.
5. Sensor Switch, Inc.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox. Sensor contains two relays and buttons for controlling two independent lighting loads.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology. 0-10V dimming controls.
2. Hold to raise/lower buttons
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. Adjustable time delay of 15 minutes.

2.6 LIGHTING CONTROL PANEL WITH INEGRAL TIMECLOCK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Leviton Manufacturing Co., Inc. GreenMAX system or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.

3. Lighting Control and Design (LC&D)
4. Wattstopper.
5. Lutron.
6. Crestron.

B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.

C. Lighting Control Panels:

1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.

D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.

1. Ethernet Communications: Comply with TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
2. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.

    a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
    b. Panel summary showing the master and slave panels connected to the controller.
    c. Controller diagnostic information.
    d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.

3. Timing Unit:

    a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
    b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
    c. Four independent schedules, each having 24 time periods.
    d. Schedule periods settable to the minute.
    e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
    f. 16 special date periods.

4. Time Synchronization: The timing unit shall be updated not less than every four hour(s) with the network time server.
5. Sequencing Control with Override:

    a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
    b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.

c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
d. Override control "blinking warning" shall warn occupants approximately five minutes before actuating the off sequence.
e. Activity log, storing previous relay operation, including the time and cause of the change of status.
f. Download firmware to the latest version offered by manufacturer.

E. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.

1. Electronic control for operating and monitoring individual relays, and display relay on-time.
2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
3. Integral keypad and digital-display front panel for local setup, including the following:

a. Blink notice, time adjustable from software.
b. Ability to log and display relay on-time.
c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.

F. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. Control shall be digital control network.

G. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.

H. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.

I. Software:

1. Menu-driven data entry.
2. Online and offline programming and editing.
3. Provide for entry of the room or space designation for the load side of each relay.
4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
5. Size the software appropriate to the system.

2.7 OUTDOOR PHOTOCELLS

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. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.8 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lighting and appliance branch-circuit panelboards.
   2. Load centers.

B. Related Requirements:

   1. Section 26 43 13 "Surge Protective Devices for Low-Voltage Electrical Power Circuits" for field-installed Surge Protective Device(s) for panelboards.

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protective Device.

1.3 ACTION 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.

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.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.6 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. Keys: Six spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.8 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 NECA 407.

1.9 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.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding minus 22 deg F.
    b. Altitude: Not exceeding 6600 feet (2000 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than 15 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.10 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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Kitchen Areas: NEMA 250 Type 4X

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus an dUL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression or Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    d. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB1.1.

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 PB1.1.

B. Mount top of trim 80 inches above finished floor unless otherwise indicated.

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.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

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 to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. 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.

DISEND OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Controllable (half-controlled) duplex receptacles.
3. Tamper-resistant receptacles
4. Weather-resistant receptacles.
5. Snap switches and wall-box dimmers.
6. Floor service outlets.

B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices".

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 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. Receptacles: One for every 10 of each type installed, but no fewer than five.
2. GFCI Receptacles: One for every 10 of each type installed, but no fewer than five.
3. Tamper-resistant Receptacles: One for every 10 of each type installed, but no fewer than five.
4. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).

c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; TR8300.
b. Hubbell; HBL8300SGA.
c. Leviton; 8300-SGG.
d. Pass & Seymour; TR63H.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

C. Weather Resistant GFCI Convenience Receptacles, 125 V, 20A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following SPECIFICATION GRADE receptacles:

a. Hubbell; GFTR20W.

b. Pass & Seymour; WR5362W.

2. Comply with requirements of 2008 NEC article 406.8.

3. Comply with requirements of UL 498 for weather resistant receptacles.

4. Receptacle must bear the “WR” letters on front of receptacle.

2.5 CONTROLLABLE (HALF-CONTROLLED) DUPLEX RECEPTACLES

A. Controllable (Half-Controlled) Duplex Receptacles, 125 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour/Legrand (Pass & Seymour) ; 26352CHW. or a comparable product by one of the following:

    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.

2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.
5. Permanent marking per NEC 2017 Article 406.3-E with the word “CONTROLLED” clearly displayed on face of receptacle.

2.6 TOGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Single Pole:

        1) Cooper; AH1221.
        2) Hubbell; HBL1221.
        3) Leviton; 1221-2.
        4) Pass & Seymour; CSB20AC1.

    b. Two Pole:

        5) Cooper; AH1222.
        6) Hubbell; HBL1222.
        7) Leviton; 1222-2.
        8) Pass & Seymour; CSB20AC2.

    c. Three Way:

        9) Cooper; AH1223.
        10) Hubbell; HBL1223.
        11) Leviton; 1223-2.
        12) Pass & Seymour; CSB20AC3.

    d. Four Way:

        13) Cooper; AH1224.
        14) Hubbell; HBL1224.

15) Leviton; 1224-2.
16) Pass & Seymour; CSB20AC4.

2.7 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Round, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable.

2.10 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. 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 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. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right 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.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that 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. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 CONTROLLED RECEPTACLES

A. Provide occupancy sensors for control of receptacles to comply with the International Green Construction Code.

B. Mark controlled receptacles to differentiate them from uncontrolled receptacles.

3.4 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Mark controlled receptacles to differentiate them from uncontrolled receptacles.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.
2. Spare-fuse cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Fuse sizes for elevator feeders and elevator disconnect switches.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.4 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, 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 FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.

4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK5, time delay.
2. Elevators: Class J, time-delay.
3. Other Branch Circuits: Class RK1, time delay
4. Control Circuits: Class CC, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 ACTION 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, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Manufacturer's field service report.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.6 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, 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 NFPA 70.

1.8 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.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than 15 days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, as indicated, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

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. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. 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; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. 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.

D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

E. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4X.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 28 16

SECTION 26 29 13 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.6 MATERIALS MAINTENANCE 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. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10percent of quantity installed for each size and type, but no fewer than three of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish two spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.7 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.8 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 (40 deg C).

2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than 15 days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without the Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of enclosed controllers 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 installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers with Hand-Off-Auto switch: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Siemens Energy & Automation, Inc.
e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
4. Surface mounting.
5. Red-run and Green-off, push to test pilot lights.
6. Hand-Off-Auto rotary switch
7. 2 N.O. and 2 N.C. auxiliary contacts.

C. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Siemens Energy & Automation, Inc.
e. Square D; a brand of Schneider Electric.

2. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

3. Auxiliary Contacts: 2 N.O. and 2N.C., arranged to activate before switch blades open.
4. Red-run and Green-off, push to test pilot lights.
5. Hand-Off-Auto rotary switch

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 4X.
3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.

a. Push Buttons: Covered types; maintained as indicated.
b. Pilot Lights: LED types; colors as indicated; push to test.
c. Selector Switches: Rotary Hand-Off-Automatic selector switch.

B. N.C. N.O. auxiliary contact(s).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 "Fuses."

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Section 26 05 23 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.]
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed controllers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 26 29 13

SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted external SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. References:

1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low- Voltage (1000 V and Less) AC Power Circuits.
2. ANSI/IEEE Std C62.41.2™-2002,IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
3. ANSI/IEEE Std C62.45™ -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
5. IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment - Clause 8.6.1.
6. National Fire Protection Association (NFPA) 70 (N.E.C.) –2014 – Article 285.
7. ANSI/UL 1449 fourth edition - Surge Protective Devices.
8. IEEE Std C62.72™-2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits.

1.2 DEFINITIONS

A. Type 1 SPD – 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. Type 2 SPD – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel.

C. Type 3 SPD – Point of utilization SPDs, installed at a minimum conductor length of 30 feet from the electrical service panel to the point of utilization, for example cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected.

D. Type 4 SPD – Recognized Component SPDs, including discrete components as well as component assemblies, which bear specific conditions of acceptability.

E. Inominal: Nominal discharge current. Peak value of the current, selected by the manufacturer from a list of values specified in ANSI/UL fourth edition, through the SPD having a current waveshape of 8/20 where the SPD remains functional after 15 surges using the test procedure described in ANSI/UL 1449-fourth edition.

F. LTV: Let-Through Voltage. The part of the surge that passes by a surge-protective device (SPD) with little or no alteration. Also known as the measured limiting voltage.

G. MCOV: Maximum continuous operating voltage. The maximum designated root mean-square (rms) value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

H. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies. Electrical paths where the SPD offers defense against transient overvoltages. e.g. Each Line to Neutral (L-N), Line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).

I. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

J. OCPD: Overcurrent protective device.

K. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

L. SCCR: Short-circuit current rating.

M. SPD: Surge protective device.

N. VPR: Voltage protection rating. A rating selected from a list of preferred values as detailed in ANSI/UL 1449-fourth edition and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from a list of preferred values as detailed in ANSI/UL 1449-fourth edition to the measured limiting voltage (let thru voltage) determined during the transient-voltage surge suppression test using the combination wave generator at a setting of 6 kV, 3 kA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Submittal shall be clearly marked by highlighting, circling, boxing, or similar the model numbers and product data applicable to the submittal. Extraneous data and information shall be crossed out (X) and clearly marked.

B. Provide a table indicating which panel/switchboard/equipment each SPD will serve. Table shall be formatted per the following format:

Panelboard Name	Volts, Phase, Wires, Amps	SPD Model Number

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion. Free replacement shall include damage due to lightning strikes and or damage due to electrical surges.
2. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPDs during the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

E. All SPDs shall be tested and listed to ANSI/UL 1449 4rd Edition.

2.2 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. Liebert; a brand of Emerson Electric Co.
4. ASCO.
5. Eaton.
6. Siemens Industry, Inc.
7. Square D; by Schneider Electric.

8. General Electric Company
9. Mersen.
10. Surge Suppression Inc.

B. SPDs: Type 1 where located at service entrance rated equipment and Type 2 where located at non-service entrance rated equipment.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

C. Comply with UL 1283.

D. Units must be non-modular in design and not utilize replaceable parts. SPDs are considered non-repairable items and shall be fully replaced upon failure.

E. SPDs shall be external from Panelboard. SPDs integral/internal to Panelboards is prohibited.

F. SCCR: Equal or exceed 200 kA.

G. Inominal Rating: Equal to 20 kA.

H. Discrete Modes of Protection, equal to:

1. 480Y/277V, 3-Phase, 4-Wire Panels: 7 or 10 Modes.
2. 480V, 3-Phase, 3-Wire Panels: 6 Modes.
3. 208Y/120V, 3-Phase, 4-Wire Panels: 7 or 10 Modes.

I. Peak Surge Current Rating:

1. Panelboards up to 225Amps: Equal or exceed 60kA Per Mode (120kA Per Phase).
2. Panelboards 226-800Amps: Equal or exceed 100kA Per Mode (200kA Per Phase).
3. Panelboards 801-1200Amps: Equal or exceed 150kA Per Mode (300kA Per Phase).

J. Protection modes and UL 1449 VPR shall not exceed the following:

	480Y/277V, 3Ph, 4W Panelboards	480V, 3Ph, 3W Panelboards	208Y/120V, 3Ph, 4W Panelboards
Protection Modes	UL 1449 Voltage Protection Rating (VPR)		
L-N	1200	-	700
L-L	1800	1800	1200
L-G	1200	1800	700
N-G	1200	-	700

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4X Composite.

C. Maximum Dimensions: 12” wide, 12” tall, 5” deep.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install a 3P-30A Molded Case Circuit Breaker to serve as a disconnecting means to the SPD. Provide larger size where required by a specific manufacturer to coordinate with lug/terminal sizes of wires to SPD. Coordinate with Panelboard submittal in Section 26 24 16 “Panelboards”.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Surge protective devices shall be installed neatly. Bind the phase, neutral, and ground conductors tightly, over the entire run, from the suppressor to the service panel, and always use the shortest length of connecting cable possible.

E. Use crimped connectors and splices only. Wire nuts are unacceptable.

F. Coordinate location of field installed SPDs to allow adequate clearances for maintenance, yet minimize conductor leads into panelboard.

G. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

H. Do not perform insulation resistance tests of the distribution wiring equipment with the SPDs installed. Disconnect all SPDs (all Phase, Neutral and Ground connections) before conducting insulation resistance tests, and reconnect immediately after the testing is over

3.2 FIELD QUALITY CONTROL

A. Perform the following inspections:

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
4. Verify that conductors between suppressor and points of attachment are as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Verify installation complies with installation detail on contract drawings.

B. An SPD will be considered defective if it does not pass inspections.

END OF SECTION 26 43 13

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:

1. Interior lighting fixtures, LEDs, and drivers.
2. Exterior luminaires mounted on exterior surface of building.
3. Emergency lighting units.
4. Exit signs.
5. Lighting fixture supports.

B. Related Requirements:

1. Section 26 08 00 “Commissioning of Electrical Systems.”
2. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Loudspeakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Globes and Guards: One for every **20** of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F for interior applications and 5 to 104 deg F exterior applications.

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

D. Recessed luminaires shall comply with NEMA LE 4.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

F. Diffusers 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 otherwise indicated.
    b. UV stabilized.

2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LED DRIVERS, BALLASTS, AND POWER SUPPLIES

A. Description: Electronic solid-state type. Complying with

1. Ten-year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Designed and tested to withstand electrostatic discharges up to 15,000
3. Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and under maximum case temperature.
4. Maximum inrush current of 2 amperes for 120V and 277V drivers.
5. Withstand up to a 4,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
7. Inaudible in a 27 dBA ambient.
8. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
9. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements.
10. Drivers to track evenly across:

    a. Multiple fixtures.
    b. All light levels.

11. Constant current drivers must provide models to:

    a. Support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists
    b. Support LED arrays up to 40W

12. Constant voltage drivers must provide models to:

    a. Support from 10Volts to 40Volts (in 0.5V steps) to ensure a compatible driver exists
    b. Support LED arrays up to 40W

13. Configuration tool must be available to optimize the following for LED fixtures:

    a. Light level
    b. Efficacy
    c. Thermal performance

14. Driver must be capable of operating from a supply voltage of 120 through 277VAC at 60Hz for 3-wire models.

B. 3-Wire Control

1. Continuous dimming from 100 percent to 1 percent relative light output.
2. Provide integral fault protection to prevent driver failure in the event of an input mis-wire.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: 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, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.7 EMERGENCY LIGHTING UNITS

A. 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.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

2.8 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 05 29 "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 luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attach to a minimum 20-gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

   a. Two 5/32-inch-diameter aircraft cable supports adjustable to 10 feet in length.
   b. Pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
   c. Hook mount.

2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. 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.
3. 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.
4. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
5. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Provide up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 51 19

SECTION 28 31 11 - ADDRESSABLE FIRE-ALARM SYSTEM WITH VOICE NOTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The installation of the following fire alarm devices for connection to the existing Notifier NFW-100X/XR addressable fire alarm control unit located in the electrical room on the4 first floor of the building.

    a. Manual fire-alarm boxes (manual stations).
    b. Fire alarm audible and visual notification appliances (voice alarm signaling loudspeakers and strobes).
    c. Carbon monoxide detectors.
    d. Duct smoke detectors.
    e. Addressable interface devices.
    f. Remote test stations.

B. Make necessary modifications to the existing fire-alarm control unit. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components must be capable of merging with existing configuration without degrading the performance the system.

C. Make necessary modifications to the fire alarm graphic plaque. Replace the existing floor plans comprising the fire alarm graphic plaque located adjacent to the remote LCD annunciator at the fire department entrance (west entrance vestibule). Update floor plans to include the two-story addition to the *St. Francis Neighborhood Center.*

D. The installation of new fire alarm devices will be limited to the area of the addition and other areas of the building under renovation.

E. In modifying the existing fire alarm, all new components must be compatible with and UL listed for use with the existing system.

F. Obtain and pay for permits required for the installation of the fire alarm system.

1. Fire alarm contractor must provide shop drawing submittal documents to the AHJ to obtain permit. Submittal must include, but not be limited to all of the following:

    a. Scaled floor plans with graphic scale(s), room numbers and room names which indicate the use of all rooms.
    b. Fire alarm device and cable symbol legend.
    c. Locations, including mounting heights of alarm-initiating and notification appliances.
    d. Alarm control and trouble signaling equipment.
    e. Fire alarm control panel and annunciator locations.
    f. Power connections.
    g. Battery calculations.

h. Size, type and number of conductors.
i. Voltage drop calculations.
j. Manufacturer's data sheets including model numbers and listing information for equipment, devices and materials.
k. Details of ceiling height and construction.
l. The interface of fire safety control functions.
m. Fire alarm system riser diagram.
n. Device to device wiring.
o. Loudness and candela settings for every notification appliance.

1.2 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. FACU: Fire Alarm Control Unit

D. HLI: High Level Interface.

E. LCD: Liquid Crystal Display.

F. LED: Light-emitting diode.

G. NICET: National Institute for Certification in Engineering Technologies.

H. VRLA: Valve Regulated Lead Acid.

I. FACU: Fire Alarm Control Unit

1.3 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings must 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 or a Licensed Fire Protection Engineer.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. NICET Level III certificate or professional Fire Protection Engineer license.
2. The name of the Lead Technician who will be responsible for the fire alarm system installation must be submitted to the Architect before any work is started on the system. Include the following:

    a. Training, qualifications and experience of the proposed individual.
    b. Copies of training certificates issued by equipment manufacturers and evidence of any other formal training received.
    c. Copies of any required state licensing documents.

B. Field quality-control reports.

1.5 Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. 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.

1.7 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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.

2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper-proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fire alarm system must be installed under the supervision of persons with the following minimum qualifications:

1. Trained and certified by manufacturer in fire-alarm system design and certified by NICET as fire-alarm Level III technician.

B. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

C. B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm devices from single source from single manufacturer. Components must be compatible with, and operate as, an extension of existing system.

D. C. 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.

1.9 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.
3. Should the fire alarm system be out of service for more than four hours in a 24-hour period, the Contractor must provide a fire watch for areas left unprotected by the shutdown in accordance with NFPA 101 and the “Impairments” Section of NFPA 72, “Fundamentals” Chapter. Individuals performing the fire watch shall be specially trained in fire prevention and in occupant and fire department notification techniques.

C. Existing Smoke and Heat Detectors: Protect all smoke and heat detectors in the work area to prevent activation of devices when work is underway.

D. Submit a plan indicating measures taken to ensure that building occupants will not be evacuated unnecessarily due to nuisance alarms. Plan must include the following:

1. Specific materials that will be used to cover fire alarm devices.
2. Procedures for bypassing devices in the fire alarm program.
3. Fire watch procedures when the fire alarm system will be out of service for more than four hours in a 24-hour period.

E. Protect devices during construction. If devices are placed in service to protect the facility during construction, replace devices prior to final acceptance.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXISTING FIRE-ALARM CONTROL UNIT: Notifier NFW-100X/XR.

A. Modify fire alarm control panel as required to accommodate additional fire alarm devices.

B. Source Limitations for Fire-Alarm System and Components: Components must be compatible with, and operate as an extension of, existing system.

1. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.
2. Notification appliances shall be of the same manufacturer and model as the existing notification appliances throughout the third floor.

C. All components provided shall be listed for use with the Silent Knight system.

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 SYSTEMS OPERATIONAL DESCRIPTION

A. The fire alarm system operation shall match the existing fire alarm system operation. Sequence of operation remains unchanged.

B. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.

2. Smoke detectors.
3. Duct smoke detectors.

C. Fire-alarm signal must initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, 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 and electromechanical door holders.
6. Activate voice/alarm communication 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 elevator to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Activate emergency lighting control.
12. Record events in the system memory.
13. Indicate device in alarm on the LCD annunciator.

D. Carbon monoxide signal initiation shall be by carbon monoxide detectors. Carbon monoxide signal must initiate the following actions:

1. Continuously operate associated alarm notification appliances by producing a distinctive alarm signal pattern in accordance with NFPA 720, 5.8.6.5,
2. Occupant notification must consist of a flashing blue light with sounder at locations indicated on the drawings.
3. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
4. Transmit supervisory alarm signal to the remote alarm receiving station.
5. Record events in the system memory.
6. Indicate device in alarm on the graphic annunciator.
7. Actuate associated blue flashing light and sounder.

E. 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. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.
5. Carbon monoxide detector.

F. 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. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.

6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

G. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, and remote annunciator.
3. Transmit supervisory signal to the remote alarm receiving station.
4. Display system status on LCD annunciator.
5. Record the event in system memory.

H. System Trouble Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, and remote annunciators.
2. Transmit trouble signal to the remote alarm receiving station.
3. Display system status on LCD annunciator.
4. Record the event in system memory.

2.3 MANUAL FIRE-ALARM BOXES (MANUAL PULL STATIONS)

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.4 PROTECTIVE COVERS FOR MANUAL PULL STATIONS

A. Description: Clear polycarbonate shield and frame to prevent false alarms

1. Basis-of-Design: STI Stopper II with the following features
   a. 95 dB Piezo warning horn powered by 9-volt DC alkaline battery.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors must be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components must be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Viewing: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at fire-alarm control unit for, sensitivity, and alarm condition

B. Photoelectric Smoke Detectors:

1. Detector address must be accessible from fire-alarm control unit and must be able to identify the detector's location within the system and its sensitivity setting.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address must be accessible from fire-alarm control unit and must be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, must be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor must have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.

6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
4. Flashing must be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

C. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Flush, semi-recessed, or surface mounted and bidirectional as required by location and field conditions.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.8 REMOTE ANNUNCIATOR – Existing Notifier ANN-80

A. Description: Existing remote annunciator is located at the fire department entrance to the building (west entrance vestibule). Functions match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

2.9 FIRE ALARM GRAPHIC PLAQUE

A. Make necessary modifications to the fire alarm graphic plaque. Replace the existing floor plans comprising the fire alarm graphic plaque located adjacent to the remote LCD annunciator at the fire department entrance (west entrance vestibule). Update floor plans to include the two-story addition to the *St. Francis Neighborhood Center.*

2.10 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to shunt trip module for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.11 WIRE AND CABLE

A. Wire and cable for fire alarm systems must be UL listed and labeled as complying with NFPA 70, Article 760.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NECA 305, NFPA 72, NFPA 101, IBC, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup must be replaced.
2. Devices installed but not yet placed in service must be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new loudspeakers and visual devices to existing or new notification circuits.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box must be between 42 inches and 48 inches above floor level. All devices must be mounted at the same height unless otherwise indicated.

E. Smoke-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Smooth ceiling spacing must not exceed 30 feet.
3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined according to Annex A in NFPA 72.
4. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.

5. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. All fire alarm wiring must be installed in rigid metal conduit or electrical metallic tubing.

B. Minimum Conduit Size: 3/4-inch inside diameter.

C. In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, conduit shall be concealed above ceilings. Clearance shall be provided above ceiling tiles and fixtures to allow access and ceiling tile removal.

D. Paint all junction box covers red.

E. Conduits and surface metal raceways shall be painted with a 1-inch-wide red band every 10 feet in unfinished areas. Conduit is permitted to be a factory-provided coating with a red finish.

F. Exposed EMT in finished areas shall be painted to match adjacent finishes.

3.4 BOXES, ENCLOSURES, AND WIRING DEVICES

A. Install boxes plumb and firmly in position.

B. Install extension rings with blank covers on junction boxes where required.

C. Junction boxes served by concealed conduit must be flush mounted.

D. Upon initial installation, install dust covers on all wiring outlets, junction, pull and outlet boxes. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. Apply "Fire Alarm System" silk-screened label to all junction box covers.

3.5 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.7 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.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.8 FIELD QUALITY CONTROL

A. Field tests must be witnessed by authorities having jurisdiction.

B. Test and inspect components, assemblies, and equipment installations, including connections.

C. Tests and inspections:

1. Prepare for final test. Ensure all components of the project's fire protection systems are inspected and pre-tested prior to requesting a final inspection visit by the AHJ. Inspection deficiencies will be referenced to NFPA requirements, and/or Contract Specification requirements. Use, as a minimum, the following pre-commissioning check list:

- NFPA 72" Fire Alarm System Record of Completion" form completed by contractor.
- System meets contract specification requirements
- O&M Manuals provided
- System has been inspected and pre-tested
- Proper batteries installed
- System is free of all trouble conditions
- System has been programmed to meet specification requirements
- Systems device text programming has been coordinated with the Owner to ensure proper device identity and location.
- Operating instructions provided at fire alarm control panel location
- All devices and components installed per approved shop drawings

- All devices properly labeled and properly identified on as-builts
- All conduit box covers in place
- No T-Tap connections or splices in circuits
- All T-Bar hangers in place where devices are installed on drop ceilings
- No flexible conduit exceeds 6 feet in length
- All concealed devices have remote lamps in visible areas
- All control relays located within 3 feet of controlled equipment
- Fire alarm communicating properly to Owner designated monitor station
- Spare parts provided

2. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection must be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "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.

3. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
4. Measure sound pressure levels with a sound level meter meeting ANSI SI.4a Specifications for Sound Level Meters, Type 2 requirements.

    a. Measure sound pressure levels throughout the protected area to confirm that they are in compliance with NFPA 72.

5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION 28 31 11

SECTION 32 18 20 POURED RUBBER PLAYGROUND SURFAC

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: SpectraPour Poured-in-Place Playground Surfacing System.

B. Related Sections: Sitework Sections: Materials and Methods, Excavation, Concrete Paving, Sub-Drainage, Storm Drainage, Fencing

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension. 2. ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

3. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

4. ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials.

5. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

6. ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.

7. ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide a 2 layer rubber-urethane playground surfacing system which has been designed, manufactured and installed to meet the following criteria:

1. Shock Attenuation (ASTM F1292):
    a. Gmax: Less than 200.
    b. Head Injury Criteria: Less than 1000.
2. Flammability (ASTM D2859): Pass.
3. Tensile Strength (ASTM D412): 60 psi (413 kPa).
4. Tear Resistance (ASTM D624): 140%.

5. Water Permeability: 0.4 gal/yd2/second.
6. Accessibility: Comply with requirements of ASTM F1951.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Verification Samples: Submit manufacturer's standard verification samples of 6" x 6" minimum.

D. Quality Assurance/Control Submittals: Submit the following:
1. Certificate of qualifications of the playground surfacing installer.

E. Closeout Submittals: Submit the following:
1. Warranty documents specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications: Utilize an installer approved and trained by the manufacturer of the playground surfacing system or a direct employee of the manufacturer's installation division, having experience with other projects of the scope and scale of the work described in this section.

B. Certifications: Certification by manufacturer that installer is an approved applicator of the playground surfacing system.

C. International Play Equipment Manufacturers Association (IPEMA) certified.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

1.07 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 95 degrees F (32 degrees C). Exception to the temperature requirements can be made by the manufacturer of the surfacing system. Do not install in steady or heavy rain.

1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Proper drainage is critical to the longevity of the SpectraPour Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.

1. Warranty Period: Five (5) years from date of completion of work.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Manufacturer: SpectraTurf, Inc.

1. Contact: 555 South Promenade Avenue, #103, Corona, CA 92879; Telephone: (800) 875-5788; Fax: (951) 734-3630; E-mail: info@spectraturf.com website: http://www.spectraturf.com.

B. Basis of Design: SpectraPour Poured-in-place playground surfacing system, including the following:

1. SpectraPour Poured-In-Place Primer:

a. Material: Urethane.

2. SpectraPour Poured-in-Place Basemat:

a. Material: 100% recycled blend of shredded SBR (styrene butadiene rubber) and urethane.
b. Basemat Thickness: 3” .

SpectraPour Poured-In-Place Top Surface:

a. Material: Blend of recycled EPDM (ethylene propylene diene monomer) rubber and aromatic or aliphatic urethane binder.

b. Top Surface Thickness: minimum 1/2", maximum 5/8".

c. Color: Three colors to be selected from Manufacturer’s Standard Range of Colors recommended for outdoor use.

d. Dry Static Coefficient of Friction (ASTM D2047): 1.0.

e. Wet Static Coefficient of Friction (ASTM D2047): 0.9. f. Dry Skid Resistance (ASTM E303): 89.
g. Wet Skid Resistance (ASTM E303): 57.

2.03 MIXES

A. Required mix proportions by weight:

1. Basemat: 16+% urethane (as ratio: 14% urethane divided by 86% rubber). 14% urethane, 86% rubber (based on entire rubber & urethane mix).

2. Top Surface: 22% urethane (ratio: 18% urethane divided by 82% rubber). 18% urethane, 82% rubber (based on entire rubber & urethane mix).

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the playground surfacing manufacturer.

3.02 EXAMINATION

A. Substrate preparation must be in accordance with surfacing manufacturer's specification. New asphalt must be fully cured – up to 30 days. New concrete must be fully cured – up to 7 days.

B. Proper drainage is critical to the longevity of the SpectraPour CA Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.

3.03 PREPARATION

A. Surface Preparation: Using a brush or short nap roller, apply primer to the substrate perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal.

3.04 INSTALLATION

A. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, fencing, playground equipment installation and other relevant work, has been completed.

B. Basemat Installation:

1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 1 ounce per cubic foot to the specified thickness.

2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traffic or equipment.

3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

C. Primer Application: Using a brush or short nap roller, apply primer to the basemat perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

D. Top Surface Installation:

1. Using a hand trowel, install top surface at a consistent density of 58 pounds, 9 ounces per cubic foot to a nominal thickness of 1/2".

2. Allow top surface to cure for a minimum of 48 hours for aromatic resin / 72 hours for aliphatic resin.

3. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.

4. Do not allow foot traffic or use of the surface until it is sufficiently cured.

3.05 PROTECTION

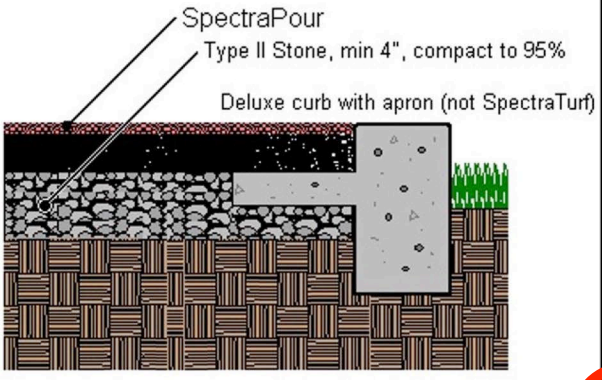
A. Protect the installed playground surface from damage resulting from subsequent construction activity on the site.

END OF SECTION

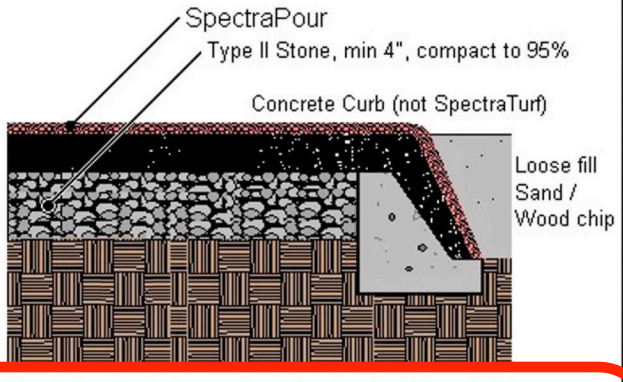
SpectraTurf
an ecore company

SpectraPour Edge Details

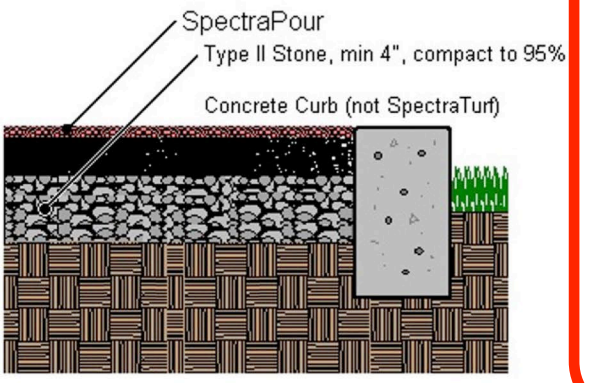
RD - 1 Deluxe Ledge Curb



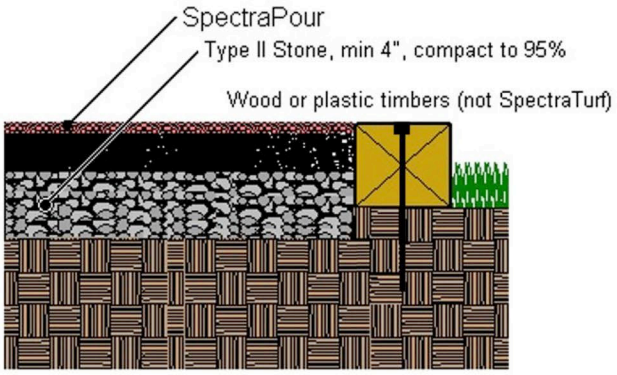
RD - 2 Turndown into loose fill



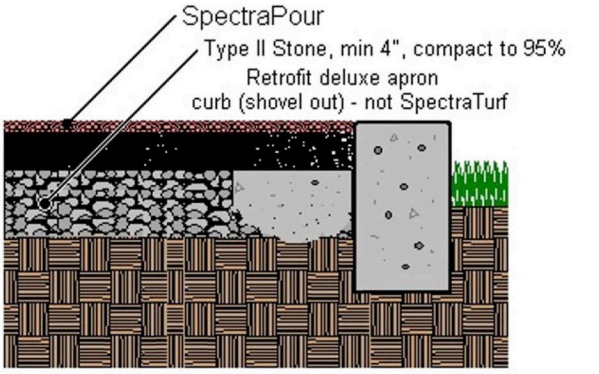
RD - 3 Standard Curb



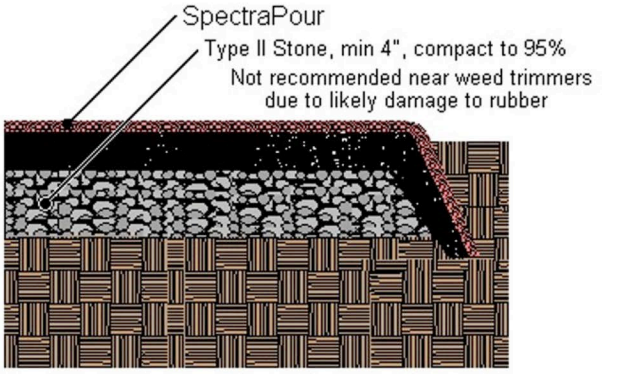
RD - 4 Timber Edge Border



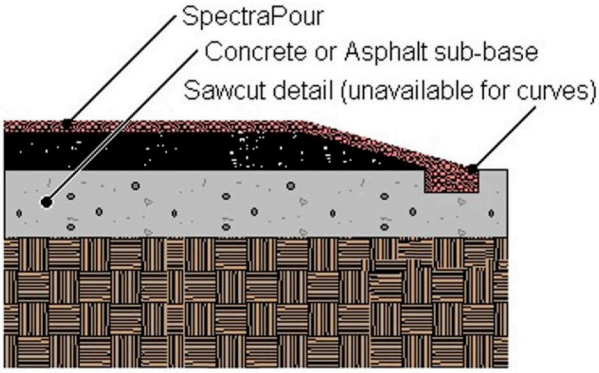
RD - 5 Retrofit Ledge Curb



RD - 6 Non-supported edge



RD - 7 Sawcut into Concrete/Asphalt



RD - 8 Standard Tapered Edge