CITY OF BALTIMORE
Brandon M. Scott
Mayor

DEPARTMENT OF GENERAL SERVICES
Berke Attila
Director

CONTRACT NO. PRJ000889

HARFORD SENIOR RENOVATION & ENVELOPE UPGRADES

4920 HARFORD ROAD
BALTIMORE, MD 21214

Marwan Alkarajat
Chief
Capital Projects Division

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END OF SECTION

CITY OF BALTIMORE
DEPARTMENT OF GENERAL SERVICES
A. NOTICE OF LETTING

Sealed Bids or Proposals, in duplicate, addressed to the Board of Estimates of the Mayor and City Council of Baltimore and marked for **PRJ000889 – Harford Senior Renovation & Envelope Upgrades,** will be received at the Office of the Comptroller, Room 204, City Hall, Baltimore, Maryland until 11:00 A.M. on **WEDNESDAY, AUGUST 5, 2026.** Board of Estimates employees will be stationed at the Security Unit Counter just inside the Holliday Street entrance to City Hall from 10:45 A.M. to 11:00 A.M. on Wednesday to receive Bids. Positively no bids will be received after 11:00 A.M. The bids will be publicly opened by the Board of Estimates in Room 215, City Hall at Noon. Bid opening proceedings can be also viewed live at https://www.charmtvbaltimore.com/live-stream at 12:00 Noon. Bid tabulation sheets detailing the bids received will be publicly posted to the Comptroller's website by COB on the date of bid opening.

The Contract Documents may be examined without charge and may be purchased for a non-refundable cost of **$100.00** by contacting Lauren Hoover at lauren.hoover@baltimorecity.gov **as of FRIDAY, JUNE 19, 2026. Conditions and requirements of the Bid are found in the bid package.**

All contractors bidding on this Contract must first be pre-qualified by the City of Baltimore Boards and Commissions. Interested contractors should call 410 396-6883 or contact the Office of Boards and Commissions at 4 South Frederick Street, 4th Floor, Baltimore, MD 21202. **If a bid is submitted by a Joint Venture ("JV"), then in that event, the documents that establish the JV shall be submitted with the bid for verification purposes.** The Prequalification Category required for bidding on this project is **E13001 – THREE STORY AND UNDER**

The Cost Qualification Range for this work shall be **$3,000,000.01 to $4,000,000.00**

A "Pre-Bidding information" session will be conducted at **4920 Harford Road, Baltimore, MD 21214 on TUESDAY, JUNE 30, 2026 AT 10:00 A.M.**

Principal Items of work for this project are:

1. **Interior Renovation of the Harford Senior Center**

The MBE goal is **24%** The WBE goal is **10%**

APPROVED:

_____
Clerk, Board of Estimates

APPROVED:

_____
Chief, Capital Projects Division

_____
Chief Solicitor

_____
Chief, Minority and Women's
Business Opportunity Office

_____
Director,
Department of General Services

ADDITIONAL BIDDING INFORMATION, REQUIREMENTS, AND CONDITIONS

1. Representatives from the Board of Estimates will be stationed at the Security Unit Counter just inside the Holliday Street entrance of City Hall from 10:45 a.m. to 11:00 a.m. every Wednesday to receive Bids.

2. Bid Guarantee: A certified check of the bidder or a bank cashier's check or a bank treasurer's check drawn on a solvent clearing house bank, made payable to the Director of Finance or a bid bond executed on the form as provided in the Bid or Proposal for an amount which is not less than that determined by multiplying the total bid submitted by two percent (2%) will be required with each bid over $100,000.00. If the bid is less than or equal to $100,000.00 no Bid Bond is required.

3. Bidders interested in utilizing the City's Self-Insurance Program for payment and performance security for contracts not exceeding $100,000.00 may contact the Department of Finance, the Program Administrator, for eligibility requirements and premium costs.

4. **All Bids will be irrevocable when filed with the Comptroller of Baltimore City. The Board of Estimates reserves the right to reject any and all Bids and/or waive technical defects, if in its judgment, the interest of the Mayor and City Council of Baltimore may so require**.

5. Pursuant to Article 5, Subtitle 28 of the Baltimore City Code - Minority and Women's Business Program, Minority Business Enterprise (MBE) and Women's Business Enterprise (WBE) participation goals apply to this contract.

6. Contractors will not be permitted to bid on any single Contract having a dollar value in excess of the contractor's Money Limit assigned by Boards and Commissions and will not be awarded any Contract if the Contract dollar value, when added to the contractor's uncompleted backlog at time of award, exceeds the contractor's assigned Money Limit.

7. Bidding Contractors must maintain a valid prequalification status through the time of award, when work commences and remain prequalified for the duration of the project. Subcontractors intending to perform City work in excess of Fifty Thousand Dollars ($50,000.00) shall qualify in the same manner as prime contractors and such qualification must be established before they are permitted to commence work.

8. Attention of the Bidders is called to all of the requirements outlined in the Baltimore City Code, Article 5, Subtitle 29 – Commercial Non-Discrimination Policy.

9. USE OF WHITE-OUT AND CROSS OUTS ON SUBMITTED BID DOCUMENTS MAY CAUSE YOUR BID TO BE DEEMED NON-RESPONSIVE.

10. This contract is subject to a **Performance Evaluation** by the Department of General Services & Department of Recreation & Parks.

END OF SECTION

*** NOTICE TO BIDDERS**

SUPPLEMENTAL BIDDING INSTRUCTION

The following instruction supplements the bidding instructions found elsewhere in the Bid Book and those referenced therein.

EACH BIDDER IS HEREBY NOTIFIED THAT HE/SHE/IT MUST COMPLETELY FILL IN THE ORIGINAL BID AND THE REQUIRED BID/PROPOSAL AFFIDAVIT AND DOCUMENTS LOCATED IN THE BID BOOK. THE ORIGINAL BID, (WHICH MUST REMAIN ATTACHED TO THE BID BOOK) PLUS THE FULLY COMPLETED DUPLICATE BID MUST BE SUBMITTED IN THE BID ENVELOPE, IF ONE IS PROVIDED FOR THAT PURPOSE.

FAILURE TO FOLLOW THESE SIMPLE DIRECTIONS MAY CAUSE YOUR BID TO BE DECLARED UNRESPONSIVE AND THE BID MAY BE REJECTED BY THE BOARD OF ESTIMATES.

MINORITY AND WOMEN'S BUSINESS PROGRAM

- INCLUDED IN THIS CONTRACT IS A MINORITY AND WOMEN'S BUSINESS PROGRAM PACKAGE.
- MINORITY AND WOMEN'S BUSINESS PROGRAM PACKAGE FORMS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL.
- FAILURE TO SUBMIT THE INFORMATION AT THE TIME REQUESTED WILL BE CAUSE TO HAVE YOUR BID REJECTED.

BALTIMORE APPRENTICESHIP TRAINEE PROGRAM (BATP)

- INCLUDED IN THIS CONTRACT IS A BALTIMORE APPRENTICESHIP TRAINEE PROGRAM PACKAGE (BATP DOCUMENTS).
- BATP FORMS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL.
- FAILURE TO SUBMIT THE INFORMATION AT THE TIME REQUESTED MAY BE CAUSE TO HAVE YOUR BID REJECTED.
- COMPLETED BATP FORMS ARE ONLY REQUIRED FOR BIDS OF $1,000,000.00 OR MORE.
- NOTE: ORIGINAL BATP FORMS ARE INCLUDED IN THE ACCOMPANYING MANILA BID ENVELOPE IF THE ENGINEER'S ESTIMATE FOR A PROJECT IS $ 750,000.00 OR MORE.

EMPLOY BALTIMORE AND BALTIMORE CITY'S YOUTHWORKS PROGRAM

- ALSO INCLUDED IN THIS CONTRACT IS AN EMPLOY BALTIMORE PACKET AND A BALTIMORE CITY'S YOUTHWORKS PROGRAM FORM.
- ALL FORMS IN THE EMPLOY BALTIMORE CERTIFICATION PACKET AND THE SINGLE PAGE BALTIMORE CITY'S YOUTHWORKS FORM MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL.
- FAILURE TO SUBMIT THE INFORMATION AT THE TIME REQUESTED MAY BE CAUSE TO HAVE YOUR BID REJECTED.

LOCAL HIRING LAW

- ALSO INCLUDED IN THIS CONTRACT IS NOTIFICATION OF THE LOCAL HIRING LAW EFFECTIVE DECEMBER 23, 2013. PLEASE REFER TO THE "INSTRUCTION TO BIDDERS" SECTION AND THE "LOCAL HIRING LAW" SECTION WITHIN THIS SPECIFICATION FOR REQUIREMENTS OF THE LAW.

NOTE:

BID/PROPOSAL AFFIDAVIT: If Awarded the contract resulting from this Bid/Proposal, the business shall remain in full compliance with all requirements of this §8 (Certification of Corporation Registration and Tax Payment) during the term, and any extensions thereof, of the said contract.

*** BOARD OF ESTIMATES RESOLUTIONS AND EXECUTIVE ORDERS**

EXECUTIVE ORDER

WHEREAS, the Mayor and City Council of Baltimore ("City") wishes to encourage all contractors awarded City contracts to agree to employ skilled and qualified Baltimore City residents to meet the contractor's employment needs created as a result of the award of a City contract; and

WHEREAS, the Mayor's Office of Employment Development ("MOED") has established the **EMPLOY BALTIMORE** program designed to create opportunities for businesses that receive City contracts to meet their workforce needs; to access qualified City job seekers; and to ensure that City dollars contribute to the local economy; and

WHEREAS, MOED has a roster of Baltimore City residents, who are skilled and qualified for immediate employment by City contractors; and

WHEREAS, MOED wishes to establish and maintain an ongoing relationship with City contractors in an effort to address current and future employment and/or training needs; and

WHEREAS, increasing employment participation of City residents is good business and a means to improve Baltimore City's employment rate.

NOW, THEREFORE, I, Stephanie Rawlings-Blake, Mayor of the City of Baltimore, by virtue of the authority vested in me by the Charter of Baltimore City, do hereby promulgate the following **EXECUTIVE ORDER:**

1. This Executive Order shall apply to contracts awarded by the City that are in the amounts of $50,000.01 to $300,000.00, except for professional service contracts and emergency contracts.

2. Bidders on all contracts awarded by the City in the amounts of $50,000.01 to $300,000.00, except for professional service contracts and emergency contracts, shall complete the **Employ Baltimore Certification Statement** contained in the Bid Document and submit it with their bids.

3. Within two (2) weeks of receiving the award of a City contract, the contractor shall schedule a meeting with MOED to: (a) assess its employment needs, and (b) discuss other services provided by MOED. If applicable, MOED will then tailor specific hiring and/or training programs to benefit the contractor. The contractor will not receive its first progress payment under the contract, unless and until the said meeting has been scheduled.

4. Should the contractor's workforce plan indicate a need to fill new jobs, the contractor must agree to post these positions through MOED and its One Stop Career Center Network for a period of seven (7) days prior to publicly advertising the openings. This will enable MOED to identify and refer qualified City residents to the contractor as candidates for these job opportunities.

5. Each contractor shall submit an **Employ Baltimore** Employment Report to MOED on June 30th and December 31st during each and every year of its contract, and at the end of the contract, indicating the number of City residents on its payroll. The submission of the Employments Reports as required shall be a condition precedent to the City's release of a final payment or any and all retainage held by the City, pursuant to the contract.

6. A copy of this **Executive Order** shall be included in all bids, requests for proposals and/or contracts.

7. This **Executive Order** applies to all applicable City contracts entered into on or after December 23, 2013.

8. This **Executive Order** supersedes the Resolution of the Board of Estimates for the Employ Baltimore Executive Order signed by the Mayor on June 9, 2011, and shall take effect immediately.

IN WITNESS HEREOF, I HAVE HEREUNTO PLACED MY HAND AND THE GREAT SEAL OF THE CITY OF BALTIMORE THIS _____ DAY OF _____, 2013.

STEPHANIE RAWLINGS-BLAKE, MAYOR

Approved As To Form and Legal Sufficiency By The Law Department Of Baltimore City:

Michael Schrock
Chief Solicitor

ATTEST:

Custodian of City Seal

Alternate

APPROVED BY THE BOARD OF ESTIMATES:
DEC 1 8 2013
Date

Clerk

CITY OF BALTIMORE
ORDINANCE ____
Council Bill 12-0159

Introduced by: President Young, Councilmembers Henry, Branch, Middleton, Curran, Kraft, Spector, Welch, Clarke, Stokes, Mosby, Scott, Cole, Reisinger
Introduced and read first time: November 19, 2012
Assigned to: Taxation, Finance and Economic Development Committee
Committee Report: Favorable, and amended by a Floor Amendment
Council action: Adopted
Read second time: May 13, 2013

AN ORDINANCE CONCERNING

Finance and Procurement – Local Hiring

FOR the purpose of requiring employers benefitted by City contracts and subsidies to take measures to hire Baltimore City residents; making certain exceptions; defining certain terms; requiring employment reports; establishing certain penalties; and generally relating to employment in furtherance of City contracts and City-subsidized projects.

BY adding
Article 5 - Finance, Property, and Procurement
Section(s) 27-1 to 27-10 to be under the new subtitle,
"Subtitle 27. Local Hiring"
Baltimore City Code
(Edition 2000)

SECTION 1. BE IT ORDAINED BY THE MAYOR AND CITY COUNCIL OF BALTIMORE, That the Laws of Baltimore City read as follows:

Baltimore City Code

Article 5. Finance, Property, and Procurement

Subtitle 27. Local Hiring

§ 27-1. DEFINITIONS.

(A) *IN GENERAL.*

IN THIS SUBTITLE, THE FOLLOWING TERMS HAVE THE MEANINGS INDICATED.

(B) *BENEFICIARY.*

"BENEFICIARY" MEANS ANY PERSON WHO:

EXPLANATION: CAPITALS indicate matter added to existing law.
[Brackets] indicate matter deleted from existing law.
Underlining indicates matter added to the bill by amendment.
~~Strike-out~~ indicates matter stricken from the bill by amendment or deleted from existing law by amendment.

(1) HAS A CONTRACT WITH THE CITY FOR MORE THAN $300,000; OR

(2) WILL BENEFIT FROM MORE THAN $5,000,000 IN ASSISTANCE FOR A CITY-SUBSIDIZED PROJECT.

(C) *CITY-SUBSIDIZED PROJECT.*

"CITY-SUBSIDIZED PROJECT" MEANS ANY PROJECT FOR WHICH THE CITY OR ANY OF ITS AGENTS OR CONTRACTORS PROVIDES FUNDS, RESOURCES, OR FINANCIAL ASSISTANCE, INCLUDING:

(1) THE SALE OR TRANSFER OF LAND SUBSTANTIALLY BELOW ITS APPRAISED VALUE;

(2) PAYMENT IN LIEU OF TAXES;

(3) TAX INCREMENT FINANCING;

(4) GRANTS OR LOANS THAT EQUAL OR EXCEED 15% OF TOTAL PROJECTED PROJECT COSTS; OR

(5) INSTALLATION OR REPAIR OF PHYSICAL INFRASTRUCTURE DIRECTLY RELATED TO THE PROJECT AND WITH VALUE EQUAL TO OR EXCEEDING 5% OF TOTAL PROJECTED PROJECT COSTS.

(D) *MOED.*

"MOED" MEANS THE MAYOR'S OFFICE OF EMPLOYMENT DEVELOPMENT.

(E) *PERSON.*

"PERSON" MEANS:

(1) AN INDIVIDUAL;

(2) A PARTNERSHIP, FIRM, ASSOCIATION, CORPORATION, OR OTHER ENTITY OF ANY KIND; OR

(3) A RECEIVER, TRUSTEE, GUARDIAN, PERSONAL REPRESENTATIVE, FIDUCIARY, OR REPRESENTATIVE OF ANY KIND.

§ 27-2. SCOPE OF SUBTITLE.

(A) *CITY CONTRACTS OVER $300,000.*

THIS SUBTITLE APPLIES TO EVERY CONTRACT FOR MORE THAN $300,000 MADE BY THE CITY, OR ON ITS BEHALF, WITH ANY PERSON.

(B) *CITY-SUBSIDIZED PROJECTS RECEIVING ASSISTANCE OVER $5,000,000.*

THIS SUBTITLE APPLIES TO EVERY AGREEMENT AUTHORIZING ASSISTANCE VALUED AT MORE THAN $5,000,000 TO A CITY-SUBSIDIZED PROJECT.

§ 27-3. *[RESERVED]*

§ 27-4. EMPLOYMENT ANALYSIS.

BEFORE THE DISBURSEMENT OF ANY CITY FUNDS, THE BENEFICIARY MUST PERFORM AN EMPLOYMENT ANALYSIS WITH MOED TO DETERMINE HOW MANY JOBS WILL BE REQUIRED TO COMPLETE THE CONTRACT OR PROJECT AND HOW MANY OF THOSE JOBS WILL REQUIRE NEW HIRING.

§ 27-5. INITIAL HIRING TO BE THROUGH MOED.

ALL NEW JOBS NEEDED FOR THE CONTRACT OR PROJECT MUST BE POSTED THROUGH MOED FOR A PERIOD OF 7 DAYS BEFORE BEING PUBLICALLY ADVERTISED.

§ 27-6. NEW EMPLOYEES TO BE BALTIMORE CITY RESIDENTS.

(A) *IN GENERAL.*

AT LEAST 51% OF THE NEW JOBS REQUIRED TO COMPLETE THE CONTRACT OR PROJECT MUST BE FILLED BY BALTIMORE CITY RESIDENTS.

(B) *EXCEPTIONS.*

MOED MAY WAIVE OR LOWER THE REQUIREMENT OF SUBSECTION (A) OF THIS SECTION IF IT FINDS THAT:

(1) A GOOD FAITH EFFORT TO COMPLY HAS BEEN MADE BY THE BENEFICIARY;

(2) THE BENEFICIARY IS LOCATED OUTSIDE THE BALTIMORE STANDARD METROPOLITAN STATISTICAL AREA AND NONE OF THE CONTRACT WORK IS PERFORMED INSIDE THE BALTIMORE STANDARD METROPOLITAN STATISTICAL AREA;

(3) THE BENEFICIARY HAS ENTERED INTO A SATISFACTORY SPECIAL WORKFORCE DEVELOPMENT TRAINING OR PLACEMENT ARRANGEMENT WITH MOED; OR

(4) THERE ARE INSUFFICIENT NUMBERS OF BALTIMORE CITY RESIDENTS IN THE LABOR MARKET WHO POSSESS THE SKILLS REQUIRED BY THE NEW JOBS NEEDED TO BE FILLED FOR THE CONTRACT OR PROJECT.

§ 27-7. RULES AND REGULATIONS.

(A) *MOED TO ADOPT.*

MOED MAY ADOPT RULES AND REGULATIONS TO CARRY OUT THIS SUBTITLE OR TO CLARIFY ANY TERMS OR PHRASES IN THIS SUBTITLE.

(B) *FILING.*

A COPY OF ALL RULES AND REGULATIONS ADOPTED UNDER THIS SUBTITLE MUST BE FILED WITH THE DEPARTMENT OF LEGISLATIVE REFERENCE BEFORE THEY BECOME EFFECTIVE.

§ 27-8. REQUIRED REPORTS.

IN EACH MONTH OF THE CONTRACT OR PROJECT THE BENEFICIARY MUST SUBMIT A REPORT TO MOED, ON THE FORM DESIGNATED BY MOED, THAT INCLUDES THE FOLLOWING:

(1) THE NUMBER OF EMPLOYEES NEEDED FOR THE CONTRACT OR PROJECT;

(2) THE NUMBER OF CURRENT EMPLOYEES TRANSFERRED;

(3) THE NUMBER OF NEW JOB OPENINGS CREATED;

(4) THE NUMBER OF JOB OPENINGS LISTED WITH MOED;

(5) THE TOTAL NUMBER OF BALTIMORE CITY RESIDENTS HIRED FOR THE REPORTING PERIOD AND THE CUMULATIVE TOTAL NUMBER OF BALTIMORE CITY RESIDENTS HIRED;

(6) TOTAL NUMBER OF ALL EMPLOYEES HIRED FOR THE REPORTING PERIOD AND THE CUMULATIVE TOTAL OF EMPLOYEES HIRED; AND

(7) FOR EACH NEW HIRE DURING THE REPORTING PERIOD, THE NEW HIRE'S:

(1) NAME;

(2) SOCIAL SECURITY NUMBER;

(3) JOB TITLE;

(4) HIRE DATE;

(5) RESIDENCE; AND

(6) REFERRAL SOURCE.

§ 27-9. *{RESERVED}*

Council Bill 12-0159

§ 27-10. PENALTIES.

(A) *DEBARMENT FOR 1 YEAR.*

IF THE BOARD OF ESTIMATES, ON RECOMMENDATION FROM MOED, AND AFTER NOTICE AND HEARING, DETERMINES THAT ANY BENEFICIARY HAS VIOLATED THE PROVISIONS OF THIS SUBTITLE AND THAT THE FAILURE WAS INTENTIONAL, NO CONTRACT MAY BE AWARDED TO THAT BENEFICIARY, OR TO ANY FIRM, CORPORATION, OR PARTNERSHIP IN WHICH THAT BENEFICIARY HAS AN INTEREST, UNTIL 1 YEAR HAS ELAPSED FROM THE DATE OF THE DETERMINATION.

(B) *CRIMINAL PENALTIES.*

AN INTENTIONAL VIOLATION OF ANY PROVISION OF THIS SUBTITLE IS A MISDEMEANOR, AND, ON CONVICTION, IS SUBJECT TO A FINE OF NOT MORE THAN $500 FOR EACH OFFENSE.

SECTION 2. AND BE IT FURTHER ORDAINED, That the catchlines contained in this Ordinance are not law and may not be considered to have been enacted as a part of this or any prior Ordinance.

SECTION 3. AND BE IT FURTHER ORDAINED, That this Ordinance takes effect on the ~~30th~~ 180th day after the date it is enacted.

Certified as duly passed this _____ day of _____, 20___

_____
President, Baltimore City Council

Certified as duly delivered to Her Honor, the Mayor,

this _____ day of _____, 20___

_____
Chief Clerk

Approved this _____ day of _____, 20___

_____
Mayor, Baltimore City

EXECUTIVE ORDER

WHEREAS, the Mayor and City Council of Baltimore ("City") is committed to promoting the well-being and positive development of the City's youth and providing educational and enrichment opportunities which will lead to academic improvement, safer environments and a reduction in high risk behavior; and

WHEREAS, Baltimore City has an estimated 76,000 citizens between the ages of 14-21; and

WHEREAS, the federal government ceased funding summer job programs for youth in 2000 after 25 years, causing local and state governments to join with businesses, philanthropic, faith-based, community, and educational organizations to obtain grants, tax-deductible donations and job opportunities to help these deserving youth; and

WHEREAS, the City and the Mayor's Office of Employment Development ("MOED") have established the **Baltimore City's YouthWorks** program to prepare dependable Baltimore City high school and college students for productive employment that meets the workforce needs of local businesses; and

WHEREAS, the City wishes to encourage all local businesses and contractors, service providers, consultants and vendors, etc. doing business with the City to employ skilled and qualified Baltimore City youth between the ages of 14-21, who meet the job-ready status, as defined by **Baltimore City's YouthWorks** program, during the summer of 2008; and

WHEREAS, the need to help Baltimore City's youth has never been greater.

NOW, THEREFORE, I Sheila Dixon, Mayor of the City of Baltimore, by virtue of the authority vested in me by the Baltimore City Charter, do hereby promulgate the following **EXECUTIVE ORDER:**

1. Henceforth, each and every Solicitation from every City Department, Agency and Office, where the Bid is expected to be $25,000 or more, shall contain the attached form. Each and every Bidder shall provide the City with the (a) name, (b) complete address, (c) telephone number and (d) a contact person to assist MOED with the YouthWorks program.

2. MOED shall contact each and every business identified in §1 above and request that the business, contractor, service provider, consultant and vendor, etc. join with the City in reaching its goal of employing **Baltimore City's YouthWorks** referrals, or otherwise assist the **Baltimore City's YouthWorks** program.

3. MOED shall establish and maintain an ongoing relationship with City businesses, contractors, service providers, consultants and vendors, etc. in an effort to address their current and future employment and/or training needs.

4. This Executive Order shall take effect immediately.

IN WITNESS HEREOF, I HAVE PLACED MY HAND AND THE GREAT SEAL OF THE CITY OF BALTIMORE THIS 14TH DAY OF JANUARY 2008.

SHEILA DIXON, MAYOR

Approved As To Form And Legal Sufficiency By The Law Department Of Baltimore City:

Leslie S. Winner
Chief Solicitor

Executive Order – youthworks - update

RESOLUTION OF THE BOARD OF ESTIMATES
OF THE CITY OF BALTIMORE

WHEREAS, the Mayor and City Council of Baltimore, acting by and through the Board of Estimates pursuant to Article VI, Section 4 of the Charter of Baltimore City, 1964 Revision, as amended, is responsible for awarding contracts and supervising all purchasing by the City; and

WHEREAS, the Board of Estimates wishes to insure that all City contractors, subcontractors and their agents and employees conduct themselves in accordance with established federal, state, and local laws.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ESTIMATES OF BALTIMORE CITY, that the following policy, which has always been applicable to City contracts, be formally adopted by this Board to apply to all City contractors, subcontractors and their agents and employees:

1. Contractors, subcontractors, and their agents and employees may not engage in unfair labor practices as defined under The National Labor Relations Act and applicable federal regulations and state laws.

2. Contractors, subcontractors, and their agents may not threaten, harass, intimidate or in any way impede persons employed by them who on their own time exercise their rights to associate, speak, organize, or petition governmental officials with their grievances.

3. If the Board of Estimates determines that a contractor, subcontractor, or their agents have violated the policy set forth in this Resolution said contractor, or subcontractor will be disqualified from bidding on City contracts, and if they are currently completing contracts, they will be found in default of their contracts.

4. A copy of this Resolution must be included in all City contracts.

5. This Resolution applies to all City contracts entered into after the date of its adoption and to each and every City contract, or subcontract in effect on the date of its adoption, and each department and agency of the City is charged with the responsibility of so notifying all present contractors, and subcontractors.

6. This Resolution takes effect immediately.

APPROVED BY THE BOARD OF
ESTIMATES

(Signed)

Shirley A. Williams June 29, 1994
Clerk Date

Approved As To Form And
Legal Sufficiency This
28th Day of June, 1994

(Signed)Leslie S. Winner
Leslie S. Winner
Principal Counsel

RESOLUTION OF THE BOARD OF ESTIMATES
APPRENTICESHIP TRAINING PROGRAMS

WHEREAS, the Mayor and City Council of Baltimore, acting by and through the Board of Estimates, pursuant to Article VI, Section 4 of the Charter of Baltimore City, 1964 Revision, as amended, is responsible for awarding contracts and supervising all purchasing by the City; and,

WHEREAS, the Board of Estimates wishes to insure that all prime contractors performing under any City construction contract conduct apprenticeship training programs as a condition of their contracts;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ESTIMATES OF BALTIMORE CITY, that the following policy applies to all prime contractors performing under any construction contract of the City that has a total cost of $ 1,000,000.00 or more:

1. Prime Contractors shall conduct apprenticeship training programs as a condition of their contracts.

2. Prime Contractors shall submit to the contract administrator for the City agency supervising the contract, within ten days of their receipt of notice of award of each contract, evidence of its participation in a certified apprenticeship program that has been previously approved by the contract administrator, or an apprenticeship training action plan for approval by the contract administrator. Prime Contractors will further submit, from time to time as requested by the contract administrator, evidence of and statistics concerning the apprenticeship training actually performed by the Prime Contractors in connection with each City contract.

3. If the Board of Estimates determines that a Prime Contractor has violated the policy set forth in this Resolution, then the Prime Contractor may be disqualified from bidding on future City contracts, or may be found in default of its existing contract.

4. A copy of this Resolution must be included in all City contracts.

5. This Resolution applies to all City Contracts entered into after the date of its approval by the Board of Estimates.

6. This Resolution takes effect immediately.

RESOLVED BY THE BOARD OF ESTIMATES

6.

7. **JUNE 28 1995**

Clerk

9. **Date**

10.

11. **Approved as to form and legal sufficiency**

12.

Richard E. Kagan
Richard E. Kagan
Associate City Solicitor

13.

NOTICE: Resolution Effective February 05, 2014.

RESOLUTION OF
THE BOARD OF ESTIMATES OF BALTIMORE CITY

THE REGULATION OF BOARD OF ESTIMATES MEETINGS AND PROTESTS

WHEREAS, the Mayor and City Council of Baltimore, acting by and through the Board of Estimates ("Board"), pursuant to Article VI, § 1 et seq. of the Charter of Baltimore City, 1996 Edition, as amended (HEREIN after referred to as "Charter"), is responsible for formulating and executing the fiscal policy of the City, approvals of settlements, acquisitions and dispositions of real property, awarding contracts and supervising purchasing by the City; and other duties as prescribed in the Charter; and

WHEREAS, the Board, pursuant to Article VI, § 1 of the Charter is composed of the Mayor, President of the City Council, Comptroller, City Solicitor, and Director of Public Works, and the President of the City Council shall be President of the Board, and one of the members shall act as Secretary; and

WHEREAS, the members of the Board meet in public forum each Wednesday at 9:00 a.m. (unless in periodic recess) in the Hyman Pressman Hearing Room to conduct the business of government; and

WHEREAS, the Board, pursuant to Article VI, § 2 et seq. of the Charter, may promulgate rules and regulations and summon before it heads of departments, bureaus or divisions, municipal officers, and members of commissions and boards; and

WHEREAS, in the interest of promoting better government, order and efficiency the Board wishes to establish certain rules, applicable to all private individuals, business entities, fraternal organizations, special interest groups, associations and other entities, etc. (HEREIN after collectively referred to as "entity") who wish to speak at the meetings of the Board.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ESTIMATES OF BALTIMORE CITY, that the following rules for the conduct of Board meetings be formally adopted by the Board to apply to all issues to be acted upon, considered, noted, or received at any given meeting:

1. Anyone wishing to speak before the Board, whether individually or as the spokesperson of an entity must notify the Clerk of the Board in writing no later than by noon on the Tuesday preceding any Board meeting, or by an alternative date and time specified in the agenda for the next scheduled meeting. The written protest must state (1) whom you represent and the entity that authorized the representation (2) what the issues are and the facts supporting your position and (3) how the protestant will be harmed by the proposed Board action.

2. Requests to speak on matters submitted to the Board for its information, notation or status report from a previous Board action may be heard at the discretion of the President of the Board. This rule does not preclude the submitting agency from orally presenting the report or matter at the meeting of the Board.

3. Matters may be protested by any entity directly and specifically affected by a pending matter or decision of the Board. The person or entity must submit a written protest of that matter or pending decision. In order for a protest to be considered, the protestant must be present at the Board of Estimates meeting.

4. An entity affected by the disposition of the matter in a way different than an average taxpayer or citizen and who so specifies to the satisfaction of the Board may have their protest heard and considered by the Board. However, the President of the Board reserves the right to call a person or organization to give testimony that he/she determines furthers the effective and fair decision making process of the Board. Protests filed by persons not affected by the disposition of the matter in a way different than an average taxpayer or citizen will be handled and responded to as may be determined by the Clerk of the Board.

5. Protests may be submitted, orally presented and argued by representatives or entities directly impacted by a matter or pending decision before the Board. A Procurement Lobbyist, as defined by Part II, Sec.8-8 (c) of The City Ethics Code must register with the Board of Ethics as a Procurement Lobbyist in accordance with Section 8-12 of The City Ethics Code. If any member of the Board has sufficient information to determine that Section 8-12 has not been complied with, he or she may make a complaint to the Board of Ethics.

6. The President of the Board shall have the right to limit all speakers to items and issues on the Board agenda, as well as provide a maximum time limit available to a speaker who wishes to address the Board.

7. In the interest of promoting order and efficiency of hearings, persons who are disruptive to the hearing may be required to leave the hearing room.

8. A copy of this Resolution shall be posted in the Department of Legislative Reference, the President of the Board's web site, and the Secretary to the Board's web site and shall be included in all Solicitations.

9. This Resolution shall apply to all Board meetings which are convened two (2) weeks or more after its formal adoption.

Adopted by the Board of Estimates:

Bernice N. Taylor JAN 22 2014

Clerk **Date**

Approved As To Form and Legal Sufficiency This 14th Day of January, 2014

Chief Solicitor

RESOLUTION OF THE BOARD OF ESTIMATES OF BALTIMORE CITY

FOR A HUBZONE NEIGHBORHOOD PREFERENCE IN SOLICITATIONS

WHEREAS, pursuant to Art. VI, §2 of the Charter, the Board of Estimates ("Board") shall formulate and execute the fiscal policy of the City and may promulgate rules and regulations to exercise its powers and to perform its duties; and

WHEREAS, pursuant to Art. VI,§ 11.(a) of the Charter, the Board shall be responsible for awarding contracts and supervising all purchasing by the City as provided in this section and elsewhere in the Charter; and

WHEREAS, pursuant to Art. VI, § 11.(h)(1)(vi) of the Charter, the Board may adopt rules and regulations that establish uniform procedures for providing, on a neighborhood service, neighborhood public work, or neighborhood public improvement contract, limited bid preferences to responsive and responsible bidders who are residents of, or have their principal places of business in, that neighborhood; and

WHEREAS, the Board desires the City Purchasing Agent and City agencies to use good faith efforts to consider limited bid preferences to responsive and responsible bidders who are residents of, or have their principal place of business in neighborhoods that are within historically underutilized business zones ("HUBZones") designated by the U.S. Small Business Administration ("SBA"); and

WHEREAS, the Board desires to define "neighborhood" below for the purposes of Art. VI, § 11.(h)(1)(vi) of the Charter in a manner that assists City neighborhoods collectively which have similar challenges of low median household incomes and/or high unemployment; and

WHEREAS, the purpose of the below "HUBZone Neighborhood Preference" is to help small businesses in this "neighborhood" to gain access to City procurement opportunities which should increase employment opportunities, stimulate capital investment, and empower City neighborhoods through economic leveraging; and

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ESTIMATES OF BALTIMORE CITY, that the following resolution applies to all solicitations more than $50,000 issued by the City Purchasing Agent or City agencies under Art. VI, § 11.(h) of the Charter that meet the following requirements:

1. "Neighborhood" for the purposes of Art. VI, § 11.(h)(1)(vi) of the Charter is defined as all of the Federally-designated HUBZones in Baltimore City.
2. To be eligible for the HUBZone Neighborhood Preference, a bidder must (a) be a small business by SBA standards, (b) be owned and controlled at least 51% by U.S. citizens, (c) be a resident of or have its principal place of business in the neighborhood,(d) have at least 35% of its employees residing in the neighborhood, and (e) bid on a solicitation for a service, public work, or public improvement contract in the neighborhood.
3. For an invitation for bids, the bid of a bidder with a HUBZone Neighborhood Preference shall not be more than 10% higher than the lowest responsive and responsible bidder without a HUBZone Neighborhood Preference. For a request for proposals, the total score of a bidder with a HUBZone Neighborhood Preference shall not be lower than 90% of the total score of the highest scoring responsive and responsible bidder without a HUBZone Neighborhood Preference. The City Purchasing Agent or City agency may set the percentage (%) for the HUBZone Neighborhood Preference in an invitation for bid or request for proposals.

4. The Board may award a contract giving consideration to the HUBZone Neighborhood Preference.
5. Within 90 calendar days after the end of each fiscal year, the City Purchasing Agent and each City agency shall submit a report to the Board on the operation and effectiveness of the HUBZone Neighborhood Preference in relation to the purpose of this Resolution (i.e. small businesses gain access to City procurement opportunities, increase employment opportunities, stimulate capital investment, and empower City neighborhoods through economic leveraging in the neighborhood).
6. The HUBZone Neighborhood Preference should not be used to the extent it actually conflicts with statutes, regulations, written policies, or rules specific to the use of the funds to be expended under the contract.
7. The Department of Finance shall adopt rules and regulations to carry out this Resolution or to clarify any terms or phrases in this Resolution.
8. A copy of this Resolution shall be filed in the Department of Legislative Reference.
9. This Resolution applies to all solicitations issued 60 calendar days after the date of its adoption by the Board of Estimates.

UPON MOTION duly made and seconded, the Board of Estimates approved and adopted the aforementioned resolution.

Adopted by the Board of Estimates:

Clerk

Date OCT 28, 2015

Approved as to form and legal sufficiency:

Chief Solicitor

B. SPECIAL PROVISIONS

SP-1 CONTRACT DOCUMENTS

The Contract Documents for this project consist of but are not limited to, the following:

1. **Contract Book** which contains:

   A. Notice of Letting

   B. Special Provisions

      1) Instruction to Bidders
      2) Extra Work Certification
      3) Subcontractors Acknowledgement of progress payment
      4) Special Conditions

   C. Bid or Proposal and Detached Duplicate

   D. Agreement

   E. Bonds

   F. Construction Details and Materials

   May contain: Addendum

2. **Contract Plans**

   The following numbered and titled Plans form a part of these Contract Documents. The Engineer will furnish, from time to time as the work progresses, such supplemental drawings as may necessary for further illustrating the details of the permanent work, and the Contractor will be required to abide by any modifications, supplemental Plans and Specifications that may be furnished by the Engineer.

   The Plans referred to in the Contract Documents are entitled:

CITY OF BALTIMORE
DEPARTMENT OF GENERAL SERVICES
CONTRACT NO. PRJ000889
HARFORD SENIOR RENOVATION & ENVELOPE UPGRADES

3. **Standard Specifications**

   The City of Baltimore, Department of Public Works, Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, Issue of 2006 (the “Green Book”) is hereby made part of these Contract Documents and hereinafter referred to as “Standard Specifications”. Any references in the Contract Documents made to an Article, Section, Paragraph or Table shall refer to the Standard Specifications, unless otherwise noted.

The Green Book is available free online for download at:
http://generalservices.baltimorecity.gov/gs-major-projects/greenbook

4. **Book of Standards**

The City of Baltimore, Department of Public Works, Book of Standards are hereby made a part of these Contract Documents and hereinafter referred to as “Book of Standards”.
Any reference in the Contract Documents made to a Standard Number shall refer to the Book of Standards, unless otherwise noted.

The Book of Standards is available online at:
Microsoft PowerPoint - City of Baltimore Covers.ppt

5. **Guidelines for the Performance Evaluation of Design Consultants and Construction Contractors**

Pursuant to and in accordance with provisions of Article VI, Section 11 (c) AND 11(f) of the Charter of Baltimore City 1996 Edition, the City of Baltimore, City of Baltimore Rules for Qualification of Contractors, Performance Evaluations of Construction Contractors and Consultants and Procedures and Guidelines for Hearings before the Office of Boards and Commissions Review Committee November 30, 2016, Guidelines have been promulgated for the evaluation of the performance of design consultants and construction contractors and are hereby made a part of these Contract Documents.

1) INSTRUCTIONS TO BIDDERS

IB-1 THE STANDARD SPECIFICATIONS

The City of Baltimore Department of Public Works Specifications for Materials, Highways, Bridges, Utilities, and Incidental Structures – 2006 Edition, AKA "The Green Book" applies to this project.

The Standard Specification (The Green Book) is available free online for download at:
http://generalservices.baltimorecity.gov/gs-major-projects/greenbook

IB-2 SCOPE OF WORK

A. The "Work" to be completed under this contract shall consist of the interior renovations and envelope upgrades of the Harford Senior Center.

Harford Senior Renovation & Envelope Upgrades
4920 Harford Road
Baltimore, Maryland 21214

B. The Work defined by the Construction Drawings and these Specifications shall include, but not be limited to:

- Selective demolition of building components including but not limited to interior partitions, ceilings, doors, floor/ceiling/wall finishes, commercial food equipment and exhaust, and mechanical/electrical/plumbing systems.
- Extensive renovation and alteration of the existing building throughout the entire interior and portions of the exterior envelope.
- Site development includes but not limited to, grading, water and sanitary sewer utilities, electrical power service.
- New mechanical heating and cooling systems.
- New exhaust air ductwork and fans.
- General purpose electrical power connections, and new equipment connections.
- New lighting fixtures, controls, and wiring.
- New plumbing system piping and fixtures.
- Fire alarm system.
- New metal stud and gypsum wallboard partitions.
- New floor, wall, and ceiling finishes.
- New exterior handicap ramp and stair.
- New roofing systems and drainage devices.
- New roof framing to accommodate new rooftop equipment.
- Alternates

IB-3 LOCATION(S) OF WORK

Work under this Contract will be restricted to the location(s) listed herein. There shall be no deviation from the location(s) so specified either by additions, subtractions or alterations by the Contractor or his representative without advance written permission from the Engineer.

IB-4 CONTRACT BOOK

The successful Bidder, upon execution of the Agreement and Bonds, will receive up to five (5) copies of the Contract Book – no charge.

IB-5 BALTIMORE APPRENTICESHIP TRAINEE FORMS (BATP)

Also included in this contract is a Baltimore Apprenticeship Trainee Program package (BATP documents). The duplicate BATP forms must be completed and submitted with your bid proposal. Completed BATP forms are only required for bids of $1,000,000.00 or more. Failure to submit the information at the time requested MAY be cause to have your bid rejected.

IB-6 EMPLOY BALTIMORE PACKET

Also included in this contract is an Employ Baltimore Packet. The accompanying manila bid envelope contains Employ Baltimore Packet duplicate documents which must be completed for all contracts with bids in excess of $50,000.01. All forms in the Employ Baltimore Packet must be completed and submitted with your bid proposal. Failure to submit the information at the time requested may be cause to have your bid rejected.

IB-7 LOCAL HIRING LAW

Article 5, Subtitle 27 of the Baltimore City Code, as amended (the "Local Hiring Law") and its rules and regulations apply to every contract for more than $300,000, whether by original contract award total or by later modification, made by the City, or on its behalf, with any person. The Local Hiring Law also applies to every agreement authorizing assistance valued at more than $5,000,000 to a City-subsidized project. Please visit Local Hiring | Mayor's Office of Employment Development for details on the requirements of the law

1. Within two (2) weeks of the Board of Estimate's award of the contract or approval of the agreement, the contractor shall have a meeting, whether in person or via telephone, with MOED to complete an employment analysis and review the workforces plan required for such contract or agreement. The contractor will not receive any payments under the contract or agreement, unless and until the employment analysis is performed. Contact information for MOED can be found on its website: www.oedworks.com.

2. Should the contractor's workforce plan indicate a need to fill new jobs, the contractor shall post the new job opening with MOED's One Stop Career Center Network for a period of seven (7) days prior to its publicly advertising these opening. Further, the contractor shall interview qualified Baltimore City residents referred from MOED, and unless granted an exception, fill at least fifty-one percent of the new jobs required to complete the contract or project, with Baltimore City residents.

3. For all contracts subject to the Local Hiring Law, the contractor shall submit an Employment Report to MOED by the fifth (5^{th}) day of each month throughout the duration of the contract or agreement, regardless of whether MOED has granted a waiver of any of the Local Hiring Law's requirements.

4. Local Hiring Law is now monitored using B2Gnow. Log in to B2Gnow to view details of your contract, employment Analysis and monthly employment reports that are due. There is also Training videos which will address your questions and concerns.

IB-8 BALTIMORE CITY'S YOUTHWORKS PROGRAM

Also included in this contract is a Baltimore City's Youthworks Form. The accompanying manila bid envelop contains a Baltimore City's Youthworks Form duplicate document which must be completed for all contracts. The single page Baltimore City's Youthworks Form must be completed and submitted with your bid proposal. Failure to submit the information at the time requested MAY be cause to have your bid rejected.

IB-9 CONTRACTORS EXPENSES, PERMITS, LICENSES, CHARGES, AND NOTICES

Per the City of Baltimore, Department of Public Works, Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, Issue of 2006, Sections 00 73 18 – Contractors Expense and 01 41 26 – Permits, Licenses, Charges, and Notices in the Baltimore City Green Book, the Contractor is responsible for all permit fees. "Permit fees" shall include all fees associated with any permit necessary for the Contractor to perform work, including the building permit. Information regarding the cost of the building permit, trade permits and other permits can be found at http://static.baltimorehousing.org/pdf/permits_fees.pdf .

IB-10 BOND PREMIUM

A letter from the bonding company with the bonding rate is required. Awarded Contractor is required to provide this information upon executing the Payment and Performance Bonds.

IB-11 STATE OF MARYLAND FUNDING

If the City of Baltimore is receiving Grant or Loan funds for this project from the State of Maryland, the "PROPOSAL FORM PACKET" of the State of Maryland is included in the contract documents. This packet must be completed and submitted in accordance with the instructions listed in the packet.

IB-12 DIGITAL SPECIFICATIONS AND DRAWINGS

Specifications and Drawings for this project will be e-mailed to those who purchase the bid. All documents included in the e-mail shall be considered as part of the Bid documents.

IB-13 B2G DIVERSITY MANAGEMENT SYSTEM

MBE and WBE participation are monitored using the Diversity Management System. Contractors must log in and enter the needed information for each contract.
https://baltimorecity.diversitycompliance.com/

Below is information about upcoming training and information on the process for entering and confirming payments in the B2G Diversity Management System.
Live trainings are available-they can be found on the main page of the B2G Diversity Management System, you do not need to log in to the system. https://baltimorecity.diversitycompliance.com/

You can ask questions and get real-time answers in these trainings.
Here is how to view training opportunities

Additional helpful information-https://smba-d.baltimorecity.gov/

Information about the prime contractor and subcontractor payment confirmation process:

Once the prime contractors have added their current subcontractors and they are approved, the prime contractors will need to enter the payments that they have made to each subcontractor individually by month, the subcontractor will receive a notification to verify and confirm those payments. Once the prime contractors have added the subcontractors and the payments, SMBA&D highly suggest the prime contractors to reach out to the subcontractors to verify they have received notice to review and confirm the payments. If the wrong amounts are confirmed, or entered, or there is a discrepancy, it will require additional documentation from both parties to resolve.
The prime contractors should take the time to review the amounts they are inputting, and the subcontractors should review the amounts they are confirming.

During the term of the contract, any unjustified failure to comply with the levels of MBE and WBE participation identified in the bid is a material breach of contract. Art. 5, §28-48 (e).

2) EXTRA WORK CERTIFICATION TO ACCOMPANY REQUESTS FOR PROGRESS PAYMENTS or REQUESTS FOR PAYMENTS Per the City of Baltimore, Department of Public Works, Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, Issue of 2006, Sections 01 29 76, the following language shall be included in all requests for progress Payments:

CITY OF BALTIMORE
DEPARTMENT OF GENERAL SERVICES

CONTRACT NUMBER: PRJ000889

PROJECT: Harford Senior Renovation & Envelope Upgrades

DATE: _____
(Preferably as of end of month)

To the Director of Finance:

In reference to the above referenced contract, we hereby certify that as of the above date no extra work or other conditions that would give rise to additional costs have been authorized either in writing, verbally, or otherwise except that which is represented by fully executed Change Orders Expenditure Authorization Requests and that as of the above date we are not aware of any condition that would give rise to any additional claim upon the Mayor and City Council of Baltimore in reference to the above project, EXCEPT AS FOLLOWS:

(List exceptions here):

_____

_____

Supporting Documents
Attached hereto:

CERTIFIED CORRECT:

1. Contractor's Release
   conditional upon Final payment

_____
Name of Contractor

2. Subcontractors' Acknowledgement
   of progress Payment and Release

_____ By: _____
Date of Certification Authorized Signature

THIS FORM MUST ACCOMPANY ALL REQUESTS FOR PAYMENTS.

3) SUBCONTRACTOR'S ACKNOWLEDGEMENT OF PROGRESS PAYMENT

In accordance with the Baltimore City code, Article 5, 28-55, the payment to the subcontractors must be made within seven (7) days after the prime contractor receives payment from the City. All other terms and conditions of the Baltimore City Code, and Baltimore City Standard Specifications shall apply.

Per the City of Baltimore, Department of Public Works, Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, Issue of 2006, Sections 01 29 77, the following language shall be included in all requests for progress Payments:

SUBCONTRACTOR'S ACKNOWLEDGEMENT OF PROGRESS PAYMENT

NOTICE: THIS DOCUMENT STATES THAT YOU HAVE BEEN PAID FOR PERFORMING CERTAIN SERVICES. PLEASE READ IT CAREFULLY BEFORE SIGNING.

As of the date listed below, the undersigned subcontractor has received progress payments

totaling $ _____ **to date** for labor, services, equipment, or materials

furnished to _____
(Name of General Contractor)

on the following contract of the Mayor and City Council of Baltimore:

Contract No. PRJ000889 - Harford Senior Renovation & Envelope Upgrades

Is your company's work on this contract completed _____ Yes _____ No

Dated:_____ _____
Subcontractor Name (Company)

By_____
Name (Signature)

_____
Name (Printed) Title

THIS FORM MUST ACCOMPANY ALL REQUESTS FOR PAYMENT

4) SPECIAL CONDITIONS

SC-1 MINIMUM WAGE RATES & LABOR TRAFFICKING NOTICE REQUIREMENTS

CITY OF BALTIMORE
Brandon M. Scott, Mayor

OFFICE OF EQUITY AND CIVIL RIGHTS
WAGE COMMISSION
7 E. Redwood Street, 9th Floor
Baltimore, Maryland 21202

NOTICE TO CONTRACTORS
BALTIMORE CITY PREVAILING WAGE REQUIREMENTS

The Baltimore City Code Article. 5, Subtitle 25, "Prevailing Wages for Work Under Construction Contracts," Contractors awarded City construction contracts are required to pay their employees a "Prevailing Wage" to be determined each year by the Board of Estimates and must become thoroughly familiar with the "Prevailing Wage" requirement. A copy of the City Code, Art. 5, Subtitle 25 can be found on the City of Baltimore's website (http://civilrights.baltimorecity.gov/wage-commission). A copy of the Prevailing Wage law and Rates that apply to this contract is included.

Copies of completed payroll reports with a statement of compliance shall be submitted as follows:

Copies of completed reports shall be submitted via https://prod-cdn.lcptracker.net/login/login
Once your project has been registered, you will receive your credentials to submit payrolls.
You must contact the Wage Commission to ensure your project has been registered:

Wage Commission Contact Information
Email: wagepayrolls@baltimorecity.gov
Phone: 410-396-3141

For additional clarification regarding Article 5, Subtitle 25, please contact the Wage Commission at 410-396-4835.

MINIMUM WAGE PREVAILING WAGE RATES TO BE USED ON THIS PROJECT -- CITY OF BALTIMORE

Attached to this section of the special conditions are the minimum hourly wage rates established by the Board of Estimates to be paid to all classes of laborers, mechanics, or apprentices needed on the project,

SUBTITLE 25
PREVAILING WAGES FOR WORK UNDER CONSTRUCTION CONTRACTS

§ 25-1. Definitions.

(a) *Apprentice.*

(1) The term "apprentice" as used in this subtitle means a person at least 16 years of age who has entered into a written agreement with an employer or his agent, an association of employers, or an organization of employers, or a joint committee representing both, and which shall state the trade, craft, or occupation which the apprentice is to be taught, and the time at which the apprenticeship will begin and end.

(2) All such apprenticeship agreements shall be approved by the Maryland Apprenticeship and Training Council, and certification of such approval shall be furnished to the Wage Commission.

(b) *Contractor.*

"Contractor", as used herein, shall mean the person, firm or corporation awarded a City contract or engaged in a project receiving funds from tax increment financing in excess of $10,000,000.

(c) *Subcontractor.*

"Subcontractor", as used herein, shall mean any person, firm or corporation, other than the contractor, performing any work upon the site of the project, whether subcontractor or lower tier contractor.

(City Code, 1966, art. 1, §1(c); 1976/83, art. 1, §19(parts).) (Ord. 59-1960; Ord. 67-969; Ord.73-348; Ord. 19-226.)

§ 25-2. Scope of subtitle.

(a) *City contracts over $5,000.*

This subtitle applies to each and every contract in excess of $5,000 made by the Board of Estimates (hereinafter referred to as "the City"), or on its behalf, with any person, firm or corporation for the construction, reconstruction, erection, conversion, installation, alteration, repair, maintenance, renovation, razing, demolition, moving, removing, grading, paving, repaving, curbing, filling, excavation, or any other operation or work to be done or performed in, on, upon, or in connection with any building, bridge, viaduct, tunnel, tower, stack, or other structure, airport, land, highway, pier, wharf, sewer, drain, main, conduit, machinery, or mechanical, electrical, or other equipment.

(b) *Tax increment financing projects over $10,000,000.*

This subtitle applies to each and every project approved by the Mayor and City Council on or after January 1, 2019, receiving funds from tax increment financing in excess of $10,000,000

in the aggregate to the extent those funds are used in whole or in part for the construction, reconstruction, erection, conversion, installation, alteration, repair, maintenance, renovation, razing, demolition, moving, removing, grading, paving, repaving, curbing, filling, excavation, or any other operation or work to be done or performed in, on, upon, or in connection with any building, bridge, viaduct, tunnel, tower, stack, or other structure, airport, land, highway, pier, wharf, sewer, drain, main, conduit, machinery, or mechanical, electrical, or other equipment.

(City Code, 1950, art. 1, §14(intro par.); 1966, art. 1, §16(a); 1976/83, art. 1, §19(intro).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 89-309; Ord. 19-226.)

§ 25-3. Workday.

(a) *Regular work day.*

8 hours shall constitute a regular work day for every laborer, mechanic, and apprentice working directly upon the site of the work for any contractor or subcontractor engaged in the performance of the contract.

(b) *Overtime.*

All hours worked on Saturdays, Sundays and all hours worked in excess of 8 hours per day on Monday through Friday and all hours worked on such legal holidays as shall be designated by the Board of Estimates as overtime holidays constitute overtime hours.

(City Code, 1950, art. 1, §14(a), (b); 1966, art. 1, §16(b), (c); 1976/83, art. 1, §19(a).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348.)

§ 25-4. Worker classifications.

Every such laborer, mechanic, and apprentice shall be properly classified according to his trade and skill into a classification specifically set forth in the contract, which classification has been established by the Board of Estimates as provided herein.

(City Code, 1976/83, art. 1, §19(b).) (Ord. 67-969; Ord. 73-348.)

§ 25-5. Prevailing wages - In general.

(a) *Payment required.*

(1) Every mechanic, laborer, and apprentice shall be paid not less often than once a week, and without subsequent deduction or rebate on any account (except payroll deductions as are directed or permitted by law, by a collective bargaining agreement, or by specific written authorization from an employee), the full amount due at the time of payment computed at wage rates not less than the prevailing hourly wage rate established by the Board of Estimates and set forth in the contract.

(2) No hourly employee, other than an apprentice, working directly upon the site of the work, may be paid less than the amount established for the lowest classification on the project.

(b) *Rates to be posted.*

(1) A copy of the prevailing hourly wage rates shall be kept posted by the contractor at the site of the work in a prominent place where it can be easily seen and read by the workers.

(2) If a copy of the prevailing hourly wage rates is not posted, the contractor shall forfeit and pay to the City a penalty in the amount of $20 per day for each day on which the copy is not posted. Each day's violation constitutes a separate offense.

(City Code, 1950, art. I, §14(d); 1966, art. 1, §16(e); 1976/83, art. 1, §19(c)(1).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 89-309; Ord. 08-085.)

§ 25-6. Prevailing wages - Overtime.

(a) *Payment required.*

The contractor and every subcontractor shall pay every such laborer, mechanic, or apprentice compensation at the overtime rates established by the Board of Estimates, which shall not be less than 1½ times the regular hourly rate of pay, for all hours worked in excess of 8 hours in any work day, on a Saturday, Sunday or a legal holiday designated as an overtime holiday by the Board of Estimates.

(b) *How computed.*

No overtime hours, however, shall be compensated for more than once and overtime shall be paid only on the regular hourly rate of pay and not on the fringe benefits or their cash equivalents, provided for in § 25-17 of this subtitle.

(City Code, 1950, art. I, §14(b); 1966, art. 1, §16(d); 1976/83, art. 1, §19(c)02)) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 08-085.)

§ 25-7. Prevailing wages - Sanctions for underpayment.

(a) *$50 per day.*

In the event that any such laborer, mechanic, or apprentice shall be paid less than the compensation to which he shall be entitled hereunder, the contractor shall make restitution to such affected employee for the amount due, and shall forfeit and pay to the City a penalty in the amount of $50 per day for each employee so underpaid.

(b) *Exception.*

Provided, however, that no penalty shall be assessed for wage violations to any individual which amount to a total of less than $1 in any payroll period.

(c) *Each day a separate offense.*

Each day's violation shall constitute a separate offense.

(City Code, 1950, art. 1, §14(g); 1966, art. 1, §16(1); 1976/83, art. 1, §19(e)(3).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 89-309; Ord. 08-085.)

§ 25-8. Prevailing wages - Workers' complaints.

(a) *In general.*

Any laborer, mechanic, or apprentice may within 1 year from the date of the incident file a protest in writing with the Wage Commission, objecting to the amount of wages paid for services performed by him on a public project as being less than the prevailing wages for such services.

(b) *Retaliation prohibited.*

(1) It is unlawful for any contractor or subcontractor to discharge, reduce the compensation of, or otherwise discriminate against any laborer, mechanic, or apprentice for making a complaint to the Wage Commission, participating in any of its proceedings, or availing himself or herself of any civil remedies.

(2) In such a case, the Wage Commission may, pursuant to similar procedures as provided in Article 11, Subtitle 1 of the Baltimore City Code, as amended, order appropriate restitution or the reinstatement of such employee with backpay to the date of violation.

(City Code, 1976/83, art. I, §19(c)(4).) (Ord. 73-348; Ord. 04-672; Ord. 08-085.)

§ 25-9. Required records - In general.

(a) *Contractors to maintain.*

The contractor and each of his subcontractors shall maintain payrolls and basic records relating thereto during the course of the work and shall preserve them for a period of 3 years thereafter for all laborers, mechanics, and apprentices working directly upon the site of the work.

(b) *Contents.*

These records shall contain:

(I) the name and address of each such employee;

(2) his classification in accordance with the classifications fixed in the contract;

(3) a designation of laborer, mechanic, or apprentice;

(4) the number of hours worked each day;

(5) the hourly wage rate;

(6) the gross wages, deductions made, and actual wages paid;

(7) a copy of the Social Security returns and evidence of payment thereof;

(8) a record of fringe benefit payments including contributions to approved plans, funds, or programs and/or additional cash payments; and

(9) such other data as may be required by the Board of Estimates from time to time.
(City Code, 1950, art. 1, SI4(e); 1966, art. 1, $16 ((1" sen.); 1976/83, art. 1, $I9(d(1).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 04-672)

§ 25-10. Required records - Project payroll reports.

(a) *Contractor to submit.*

The contractor shall submit 2 complete copies of his weekly project payrolls and the weekly project payrolls of each of his subcontractors, consecutively numbered, not later than 14 days from the end of their respective payroll periods, 1 copy to be sent to the contracting agency, the other to the Wage Commission where the same will be available for public inspection during regular business hours.

(b) *Contents.*

The weekly project payrolls shall contain:

(I) the name of the prime contractor and the subcontractor, if any;

(2) a designation of the project and location;

(3) the name, Social Security Number, and occupation of each employee;

(4) his classification in accordance with the classifications fixed in the contract;

(5) a designation of laborer, mechanic, or apprentice;

(6) the number of hours worked daily by said employee at straight time and at overtime and his hourly wage rate for each;

(7) the gross wages paid to said employee per week; and

(8} such other data as may be required by the Board of Estimates from time to time.

(c) *Prime contractor responsible for subcontractors.*

The prime contractor shall be responsible for the submission of all subcontractors' payrolls covering work performed directly at the work site.

(d) *Signed statement of compliance.*

Each copy of the payroll shall be accompanied by a statement signed by the contractor or the subcontractor, as the case may be, indicating:

(1) that the payroll is correct;

(2) that the wage rates contained therein are not less than those established by the Board of Estimates as set forth in the contract;

(3) that the classification set forth for each laborer, mechanic, or apprentice conforms with the work he performed; and

(4) that the contractor and the subcontractor, as the case may be, has complied with the provisions of this subtitle.

(City Code, 1966, art. 1, $16(2" sen.); 1976/83, art. 1, $19(d)(2).) (Ord. 59-1960; Ord. 67-969; Ord. 73-348.)

§ 25-11. Required records - Delinquencies.

(a) *Payments may be withheld.*

If the contractor is delinquent in submitting his or any of his subcontractors' payrolls, processing of partial payment estimates may be held in abeyance pending receipt of the payrolls.

(b) *Fines.*

In addition, if the contractor is delinquent in submitting any payroll, the contractor shall forfeit and pay to the City a penalty of $10 for each calendar day that the weekly payroll is late.

(City Code, 1966, art. 11, $16(h); 1976/83, art. 1, $19(d)(3)) (Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 08-084.)

§ 25-12. Mechanics, apprentices, and laborers.

(a) *Mechanics and apprentices.*

(1) On any project which is operating under a contract pursuant to the provisions of this subtitle, only competent mechanics and their apprentices of the trades, crafts, and occupations involved shall be employed by the contractor and his subcontractors on the project, provided that for each such project, the ratio of mechanics to apprentices for each trade craft or occupation shall be as established by the Maryland Apprenticeship and Training Council in connection with an approved apprenticeship program.

(2) Provided, that whenever an apprentice is employed on any project which is operating under a contract pursuant to the provisions of this subtitle, the Wage Commission shall be notified of such employment.

(b) *Laborers.*

(1) Nothing in this subtitle prevents the employment of laborers to perform work not ordinarily performed by a skilled mechanic or his or her apprentice of the trade, craft, or may perform work ordinarily performed by a skilled mechanic or apprentice of the trade, craft, or occupation.

(2) Where a laborer performs the work ordinarily performed by any skilled mechanic or his or her apprentice, she or he shall be paid for the entire time she or he has performed that work at

the prevailing hourly wage rate applicable to a skilled mechanic; and in the event of underpayment, restitution shall be made by the contractor to the employee and in addition, the contractor shall be subject to a penalty as set forth in this section.

(c) *Penalties.*

(1) If the contractor or subcontractor utilizes more apprentices than permitted under the ratio established under the provisions of this subtitle, the contractor shall forfeit and pay to the City a penalty in the amount of $20 per day per employee for each violation. Each day's violation shall constitute a separate offense.

(2) If the contractor or subcontractor pays an employee a laborer's wage rate when the employee is performing work ordinarily performed by a skilled mechanic or a skilled mechanic's apprentice, the contractor shall forfeit and pay to the City a penalty in the amount of $50 per day per employee for each violation. Each day's violation shall constitute a separate offense.

(City Code, 1966, art. 1, §J(a), (b); 1976/83, art. 1, §19(e).) (Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 89-309; Ord. 08-085.)

§ 25-13. Withholding payments.

(a) *For outstanding obligations.*

The City may withhold or cause to be withheld from the contractor so much of the accrued payments as may be considered necessary:

(1) to pay such laborers, mechanics, and apprentices employed by the contractor or any subcontractor the full amount of wages required by the provisions of this subtitle; and

(2) to satisfy any liability of any contractor or subcontractor for any penalties as provided herein.

(b) *For failure to post rates.*

The City may also withhold payments from any contractor who has failed to post and keep posted a copy of the regular hourly rates as required herein, until such default shall have been corrected.

(City Code, 1976/83, art. 1, $19().) (Ord. 67-969; Ord. 73-348.)

§ 25-14. Investigations.

(a) *Agency to report irregularity.*

It shall be the responsibility of the contracting agency to promptly examine all weekly project payrolls submitted by contractors and subcontractors working upon the job site for compliance with the provisions of this subtitle and the regulations promulgated in pursuance thereof and to report any irregularities to the Wage Commission.

(b) *Commission to investigate.*

(1) The Wage Commission shall cause investigations to be made as may be necessary to determine whether there has been compliance with the provisions of this subtitle and the regulations promulgated thereunder, and contained in the contract.

(2) The contractor and subcontractors shall permit representatives of the City to observe work being performed upon the work site, to interview employees, and to examine the books and records relating to the payrolls on the project being investigated to determine the correctness of classifications, ratios or apprentices to mechanics and any payment of proper regular and overtime rates as required.

(3) Complaints of alleged violations shall be investigated promptly and statements, written or oral, made by an employee shall be treated as confidential and shall not be disclosed to his employer without the consent of the employee.

(c) *Subpoenas.*

(1) If necessary for the enforcement of this subtitle, the Wage Commission may issue subpoenas, compel the attendance and testimony of witnesses and the production of books, papers, records, and documents relating to payroll records necessary for hearings, investigations, and proceedings.

(2) Any such subpoena shall be served by the Sheriff of Baltimore City or any of his deputies.

(3) In case of disobedience to a subpoena, the Wage Commission may apply to a court of appropriate jurisdiction for an order requiring the attendance and testimony of witnesses and the production of books, papers, records, and documents. Said court, in case of contumacy or refusal to obey any such subpoena, after notice to the person subpoenaed, and upon finding that the attendance or testimony of such witnesses or the production of such books, papers, records and documents, as the case may be, is relevant or necessary for such hearings, investigations or proceedings of the Wage Commission, may issue an order requiring the attendance or testimony of such witnesses or the production of such books, papers, records and documents, and any failure to obey such order of court may be punishable by the court as contempt thereof.

(City Code, 1976/83, art. 1, SI9(g(), (2).) (Ord. 67-969; Ord. 73-348.)

§ 25-15. Penalties.

(a) *Debarment for I year.*

If the Board of Estimates, upon recommendation from the Wage Commission after notice and hearing, determines that any contractor or subcontractor has failed to pay the prevailing wage rate or has otherwise violated the provisions of this subtitle and that the failure was intentional, no contract may be awarded to that contractor or subcontractor, or to any firm, corporation or partnership in which that contractor or subcontractor has an interest until 1 year has elapsed from the date of the determination.

(b) *Criminal penalties.*

(1) And provided, further, that any such intentional violation of the provisions of this subtitle shall be a misdemeanor, punishable upon conviction by a fine of not more than $500.

(2) Proceedings before the Wage Commission shall not be considered a precondition to criminal prosecution under this subtitle.

(City Code, 1950, art. 1, §14(g); 1966, art. 1, §16(h); 1976/83, art. 1, §19(g)(3).) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 08-085.)

§ 25-16. Schedules of prevailing wage rates.

(a) *Board of Estimates to adopt, review, and revise.*

(1) The Board of Estimates may adopt, establish, repeal, modify, change, or amend, from time to time, schedules of prevailing hourly wage rates to be paid to all classes of laborers, mechanics, or apprentices directly employed by any contractor or any subcontractor on the site in any of the various types of work or projects mentioned in or contemplated by this subtitle.

(2) These schedules of prevailing hourly wage rates shall be reviewed and revised by the Board of Estimates at least once every year to conform to the area prevailing hourly wage rates.

(b) *Basis of revision.*

(1) The revision may be based on recommendations by the prevailing wage section of the Wage Commission.

(2) The schedules of prevailing hourly wage rates, including overtime rates for all hours worked on Saturdays and Sundays, and all hours worked in excess of 8 hours per day on Monday through Friday, and all hours worked on legal holidays designated as overtime holidays by the Board of Estimates may not be less in amount than the general prevailing hourly wage rates being paid to laborers, mechanics, and apprentices for doing work of a similar character in the locality in which the project is located.

(3) These general prevailing hourly wage rates shall be determined by the Board of Estimates whose decision in the matter is final.

(c) *Authority of Board not restricted.*

Nothing in this Ordinance limits or restricts in any way the power and authority of the Board of Estimates to classify the type of work to be done for the Mayor and City Council of Baltimore and to establish schedules of prevailing hourly wage rates for these classifications.

(City Code, 1950, art. 1, §15; 1966, art. 1, §18; 1976/83, art. 1, §20.) (Ord. 45-225; Ord. 59-1960; Ord. 67-969; Ord. 73-348; Ord. 08-085.)

§ 25-17. Prevailing" wage rates defined; obligation to pay.

(a) *Definitions.*

(1) In this subtitle,"prevailing hourly wage rate(s)" includes:

(i) the regular hourly rate of pay; and

(ii) the amount of:

(A) the rate of contribution irrevocably made by a contractor, subcontractor, or third person pursuant to a fund, plan, or program that provides for medical or hospital care, pensions on retirement or death, compensation for time lost from work due to injuries or illness, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of these, for unemployment benefits, life insurance, or accident insurance, for vacation and holiday pay, for defraying costs of apprenticeship or other similar programs, or for other bona fide fringe benefits, but only where the contractor or subcontractor is not required by federal, state, or local law to provide any of these benefits; and

(B) the rate of costs to the contractor or subcontractor that may be incurred in providing the fringe benefits specified in subparagraph (A) to laborers, mechanics, and apprentices pursuant to an enforceable commitment to carry out a financially responsible plan or program that is communicated to the laborers, mechanics, and apprentices affected.

(2) The amount referred to in paragraph (1)(ii)(A) shall be determined by the Board of Estimates on the basis of those fringe benefits found to be generally prevailing for laborers, mechanics, and apprentices doing work of a similar character in the locality in which the project is located. The decision of the Board of Estimates is final.

(b) *Obligation to pay.*

The obligation of a contractor or subcontractor to make payment in accordance with the schedules of prevailing hourly wage rates established by the Board of Estimates and fixed in contracts under this subtitle may be discharged by making payments in cash, by making contributions of any type referred to in subsection (a)(1)(ii)(A), or by assuming a plan or program of a type referred to in subsection (a)(1)(ii)(B), or any combination of these, where the aggregate of the payments, contributions, and costs is not less than the rate of pay described in subsection (a)(1)(i) plus the amount referred to in subsection (a)(1)(ii).

(City Code, 1976/83, art. 1, $21.) (Ord. 67-969; Ord. 73-348; Ord. 08-085.)

§ 25-18. Board of Estimates to adjudicate and assess.

(a) *In general.*

The Board of Estimates is hereby authorized and empowered to make any and alt rules and regulations from time to time, that may be necessary to effectuate the purpose of this subtitle,

including, but not limited to, the authority to make a final determination as to the amount of restitution and the amount of liquidated damages to be assessed for violations of the provisions of this subtitle.

(b) *Private action not precluded.*

In no event shall such determination of restitution preclude an employee from instituting suit to recover any underpayments due him.

(City Code, 1950, art. 1, $16; 1966, art. 1, $19; 1976/83, art. 1, $22.) (Ord. 45-225; Ord. 67-969; Ord. 73-348.)

§ 25-19. Effect of federal law.

(a) *Agreements with federal government.*

In case of any conflict between any provision of this subtitle or any minimum wage rate or any rule or regulation established or adopted by the Board of Estimates under the authority of this subtitle, and any provision of, or minimum wage rate or rule or regulation established by, contained or provided in, or contemplated by, any agreement, and any papers forming a part thereof, between the Mayor and City Council of Baltimore and the federal government, or any agency thereof, then the provision or minimum wage rate or rule or regulation of such agreement shall control.

(b) Suspension of Davis-Bacon Act.

(1) In the event that the provisions of the Federal Davis-Bacon Act are suspended as authorized by $6 of said Act then the Board of Estimates, during the period of such suspension of the Davis-Bacon Act, may suspend the application of the provisions of this subtitle with respect to any project upon which the United States Secretary of Labor would have been required to make a prevailing wage determination under said Davis-Bacon Act.

(2) Provided that if only a portion of a particular project requires a prevailing wage determination by the United States Secretary of Labor, the Board of Estimates may suspend the application of the provisions of this subtitle with respect to that portion only or with respect to the entire particular project in its discretion.

(3) Provided, however, that nothing herein contained shall be deemed to affect in any manner the provisions of this subtitle as they apply to non-federally funded projects.

(City Code, 1950, art. 1, $17; 1966, art. 1, $20; 1976/83, art. 1, $23.) (Ord. 45-225; Ord. 71-1020.)

§ 25-20. Existing contracts excepted.

Nothing contained herein shall in any manner affect or apply to any existing contract to which the Mayor and City Council of Baltimore is a party or to any contract that the Mayor and City Council of Baltimore may enter into pursuant to invitations for bids issued by the municipality prior to October 1, 1945.

(City Code, 1950, art. 1, $18; 1966, art. 1, $21; 1976/83, art. 1, $24.) (Ord. 45-225.)

§ 25-21. Inconsistent laws repealed.

Any and all laws or ordinances and any and all parts of any and all laws or ordinances in force in the City of Baltimore inconsistent with the provisions of this subtitle are hereby repealed to the extent of any such inconsistency.

(City Code, 1950, art. 1, $19; 1966, art. 1, $22; 1976/83, art 1, §25.) (Ord. 45-225.)

$ 25-22. Severability.

In case it be judicially determined that any phrase, clause, sentence, paragraph, section or part in or of this subtitle, or the application thereof to any person or circumstance, is invalid, the remaining provisions and the application of such provisions to other persons or circumstances shall not be affected thereby, the Mayor and City Council hereby declaring that they would have ordained the remaining provisions of this subtitle without the phrase, clause, sentence, paragraph, section or part, or the application thereof, so held invalid.

(City Code, 1950, art. 1, $20; 1966, art. 1, $23; 1976/83, art. 1, $26.) (Ord. 45-225.)

$ 25-23. Effect of repeal.

The repeal by this subtitle of any provision of law shall not revive any law heretofore repealed or superseded, nor shall any such repeal affect any act done, liability incurred, or any right accrued or vested, or affect, or abate, or prevent any right or penalty or punishment of any offense under the authority of such repealed laws.

(City Code, 1950, art. 1, $21; 1966, art. 1, $24; 1976/83, art. 1, $27.) (Ord. 45-225.)

2026 PREVAILING WAGE RATES

CLASSIFICATION NO.1
BUILDINGS

The following minimum hourly wage rates shall apply to all contracts in excess of five Thousand Dollars ($5,000) in connection with new building construction, major remodeling and rehabilitation of buildings and for construction, reconstruction, erection, conversion installation, alteration, renovation, razing, **demolition,** moving or removing on any airport, pier wharf, sewer, drain, main, conduit, machinery or mechanical, electrical or other equipment or any other operation, or work to be done or performed in, on, upon or in connection with any building, bridge over water, tunnel, tower, stack, filtration plant, waste water or sewage treatment works, pumping stations, and other such structures.

JOURNEYMEN	HOURLY RATE	FRINGE BENEFITS	TOTAL
Asbestos Workers (Insulation Mechanics)	$40.77	$19.77	$60.54
Boilermakers	$17.62	$6.96	$24.58
Bricklayers	$38.80	$15.57	$54.37
Carpenters/Resilient & Soft Floor Layers	$35.89	$14.60	$50.49
- Millwright	$39.50	$17.52	$57.02
- Piledriver	$35.62	$17.01	$52.63
Scaffold Builders	$35.89	$15.57	$50.49
Cement Mason/Plasterers	$28.45	$11.47	$39.32
Electricians	$52.47	$20.95	$73.42
Voice Data, Video Communication Worker, Installer, Tech	$35.10	$17.42	$52.52
Elevator Construction Mechanic	$58.81	$44.75	$103.56
Firestop Mechanic	$30.21	$10.68	$40.89
Glaziers	$36.65	$14.61	$51.26
Hazmat Handler	$24.46	$10.48	$34.94
Ironworkers			
- Ornamental	$37.60 $39.30	$27.14 $27.14	$64.74 $66.44
- Structural	$37.60	$27.14	$64.74

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2026 PREVAILING WAGE RATES

JOURNEYMEN	HOURLY RATE	FRINGE BENEFITS	TOTAL
Laborers - **General Laborers:** Flaggers, Tool and Material Handlers (Except Tenders), Clean-Up, Janitors, Truck Checkers, Dumpmen, Spotter, Landscape Laborer, Mulcher, Watchmen (Including Fire Watchmen)	**$28.34**	**$7.92**	**$36.26**
- **Semi-Skilled Laborers:** Potmen, Power or Air Tool Operators, Pipelayers, Drillers Concrete Laborers, Signalmen, Small Machine Operators, Laser Beam Operators, Scaffold Builders, Caisson Laborer, Jack Hammer Operator (80 lbs. and over), Hazmat Handler	**$28.57**	**$8.05**	**$36.62**
Painters/Commercial Painters	**$29.16**	**$12.01**	**$41.17**
Plumbers/Steamfitters/Pipefitter	**$47.78**	**$25.93**	**$73.71**
HVAC	**$46.21**	**$24.90**	**$71.11**
Roofers - Slate and Tile - Wood Block - Composition - Water proofer	 **$32.26** **$32.26** **$32.26**	 **$14.71** **$14.71** **$14.71**	 **$46.97** **$46.97** **$46.97**

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2026 PREVAILING WAGE RATES			
JOURNEYMEN	**HOURLY RATE**	**FRINGE BENEFITS**	**TOTAL**
Sheet Metal Worker (Inc. Air Balance, Metal Roofing)	**$50.92**	**$24.61**	**$75.53**
Sprinkler Fitter	**$38.67**	**$24.91**	**$63.58**
Stonemason	**$45.65**	**$21.51**	**$67.16**
Tile, Terrazzo, Marble Workers	**$34.34**	**$15.50**	**$49.84**
Tile, Terrazzo, Marble Finisher	**$28.85**	**$12.85**	**$41.70**
POWER EQUIPMENT OPERATORS			
GROUP I: Certified Crane	**$42.00**	**$19.10**	**$61.10**
GROUP IA: Gradalls, Graders, Repair Mechanic, Welders.	**$37.24**	**$14.05**	**$51.29**
GROUP II: Asphalt Paver, Batching Plants, Boat Captain, Dozers, Cableways, Loader Backhoes, Drill Rig, Concrete Mixing Plants, Concrete Bridge and Roadway Paver/Placer, Concrete Pavers, Concrete Pumps, Concrete Spreader, Concrete Slip Form Machine, Curb and Gutter Machines, Derrick Boat, Graders, Elevators, Excavators, Front-end. Loader,(1 Yard and Over), Hoist, I-li• lift, Forklifts, Milling Machines, Small Milling Machines (24 inch head or smaller), Multiple Conveyors, Locomotives, Asphalt Roller, Power Shovel, Screed Machines, Shields, Asphalt• Concrete- Stone Crusher, Stone Spreader, Trenching Machines, Tunnel Mucking Machines, Scrapers, Material Transfer Vehicle (MTV) Hydrovac Truck.	**$35.18**	**$15.12**	**$50.30**

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JOURNEYMEN	HOURLY RATE	FRINGE BENEFITS	TOTAL
POWER EQUIPMENT OPERATORS			
GROUP III: Fuel/Grease Truck, Skid Steer, Guard Rail Post Pounder, Concrete Mixer (with slip), Ditch Witch Type Trencher, Trucks (on and off road), Snooper Truck, Power Sweepers, Front End Loaders (1 Yard and u), and Articulating Trucks.	$35.18	$15.12	$50.30
GROUP IV: Caterpillar type tractors, Fireman, Grout Pump, Light Plants, Power Track Drill, Single Heaters, Dirt Roller, welding Machines, Well-Drill, Well Point sytems, Deckhands and all oilers.	$29.60	$15.12	$44.72
Group V: Deck Captain; Mechanical Dredge Operator; Leverman Licensed Tug Operator over 1000 HP.	$45.26	$12.00	$57.26
Spider/Spill Barge Operator Engineer Electrician; Chief Welder; Chief Mate Fill Placer; Operator II; Maintenance; Engineer; Licensed Boat Operator Licensed Crew Boat Operator.	$39.14	$12.00	$51.14
Boat Operator	$34.68	$12.00	$46.68
Mate, Drag Barge Operator; assistant Fill Placer, Welder, Steward.	$35.83	$12.00	$47.83

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JOURNEYMEN	HOURLY RATE	FRINGE BENEFITS	TOTAL
Truck Driver			
- Goose Neck Drop Frame	**$15.82**	**$3.75**	**$19.57**
- Trailer Driver	**$15.50**	**$3.75**	**$19.25**
- Flat Bed and Pickup	**$26.00**	**$0**	**$26.00**
- Dump Truck Driver (Site Only) Welder Receives Rate For Craft Involved	**$22.00**	**$11.21**	**$33.21**

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2026 PREVAILING WAGE RATES

APPRENTICESHIP RATES
PERCENTAGE OF JOURNEYMAN'S HOURLY RATE
PLUS, FULL JOURNEYMAN'S FRINGE BENEFITS (UNLESS PARTIAL FRINGE BENEFITS ARE APPROVED BY THE MARYLAND APPRENTICESHIP AND TRAINING

ASBESTOS WORKERS	
First year	45
Second year	55
Third year	65
Fourth year	75
Fifth year	85

BOILERMAKERS	
First 6 months	50
Second 6 months	60
Third 6 months	65
Fourth 6 months	70
Fifth 6 months	75
Sixth 6 months	80
Seventh 6 months	85
Ninth 6 months	90

BRICKLAYERS & STONE MASONS	
First 6 months	50
Second 6 months	55
Third 6 months	60
Fourth 6 months	70
Fifth 6 months	80
Sixth 6 months	90

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2026 PREVAILING WAGE RATES

APPRENTICESHIP RATES PERCENTAGE OF JOURNEYM AN' S HOURLY RATE PLUS, FULL JOURNEYM AN' S FRINGE BENEFTIS (UNLESS PARTIAL FRINGE BENEFITS ARE APPROVED BY THE MARYLAND APPRENTICESHIP AND TRAINING COUNCIL)

CARPENTERS	
First year	60
Second year	70
Third year	80
Fourth year	90

CEMENT FINISHERS	
First 500 hours	50
Second 500 hours	55
Third 500 hours	60
Fourth 500 hours	65
Fifth 500 hours	70
Sixth 500 hours	75
Seventh 500 hours	80
Eighth 500 hours	90

ELECTRICIANS	
1st Period	45
2nd Period	45
3rd Period	55
4th Period	65
5th Period	70
6th Period	75

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2026 PREVAILING WAGE RATES

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PERCENTAGE OF JOURNEYMAN'S HOURLY RATE
PLUS FULL JOURNEYMAN'S FRINGE BENEFTIS (UNLESS PARTIAL FRINGE BENEFITS ARE APPROVED BY THE MARYLAND APPRENTICESHIP AND TRAINING COUNCIL)

IRONWORKERS	
First 1,000 hours	60
Second 1,000 hours	65
Third 1,000 hours	70
Fourth 1,000 hours	75
Fifth 1,000 hours	80
Sixth 1,000 hours	85
Seventh 1,000 hours	90
Eighth 1,000 hours	95

MILLWRIGHTS	
First year	60
Second year	70
Third year	80
Fourth year	90

PAINTERS	
First year	60
Second year	70
Third year	80
Fourth year	90

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PERCENTAGE OF JOURNEYMAN'S HOURLY RATE
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PLASTERERS	
First 1,000 hours	50
Second 1,000 hours	55
Third 1,000 hours	60
Fourth 1,000 hours	65
Fifth 1,000 hours	70
Sixth 1,000 hours	75
Seventh 1,000 hours	80
Eighth 1,000 hours	85

PLUMBERS/STEAMFITTERS/ PIPEFITTERS	
First year	40
Second year	50
Third year	60
Fourth year	70
Fifth year	80

POWER EQUIPMENT OPERATORS	
First period	55
Second period	60
Third period	65
Fourth period	70
Fifth period	75
Sixth period	80

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2026 PREVAILING WAGE RATES

APPRENTICESHIP RATES PERCENTAGE OF JOURNEYMAN'S HOURLY RATE PLUS FULL JOURNEYMAN'S FRINGE BENEFTIS (UNLESS PARTIAL FRINGE BENEFITS ARE APPROVED BY THE MARYLAND APPRENTICESHIP AND TRAINING COUNCIL)

ROOFERS	
First year	55
Second year	65
Third year	75

SHEET METAL WORKERS	
First 6 months	45
Second 6 months	50
Third 6 months	55
Fourth 6 months	60
Fifth 6 months	65
Sixth 6 months	70
Seventh 6 months	75
Eighth 6 months	80
Ninth 6 months	85
Tenth 6 months	90

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2026 PREVAILING WAGE RATES

APPRENTICESHIP RATES
PERCENTAGE OF JOURNEYMAN'S HOURLY RATE
PLUS FULL JOURNEYMAN'S FRINGE BENEFITS (UNLESS PARTIAL FRINGE BENEFITS ARE APPROVED BY THE MARYLAND APPRENTICESHIP AND TRAINING COUNCIL)

LABORERS	
First year	70
Second year	90

GLAZIERS	
First year	60
Second year	70
Third year	80
Fourth year	90

LABORER'S WORK

Laborers may not assist mechanics in the performance of mechanic's work, nor use tools peculiar to established trades. Their work should be confined to the following manual tasks:

1. Digging and filling holes and trenches.
2. Loading, unloading and stockpiling materials.
3. Cleaning and sweeping.
4. Driving stakes.
5. Placing concrete and asphalt (not finishing)
6. Stripping forms.
7. Ripping out material which is to be discarded, including asbestos.
8. Clearing and grubbing.

The above definition is to preclude inadvertent misclassification of laborers.

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12/18/2025

CITY OF BALTIMORE
Brandon M. Scott, Mayor

OFFICE OF EQUITY AND CIVIL RIGHTS
WAGE COMMISSION
7 E. Redwood Street, 9th Floor
Baltimore, Maryland 21202

NOTICE TO CONTRACTORS
BALTIMORE CITY LIVING WAGE REQUIREMENTS

All service contractors and subcontractors undertaking work under contracts with the City of Baltimore are required to adhere to the mandates of the Baltimore City Code, Article 5, Subtitle 26, which delineates "Living Wages for Work Under Service Contracts." This subtitle designates specific contracts as service contracts based on the recommendation of the City Purchasing Agent and approval by the Board of Estimates. All contractors and subcontractors are hereby notified that the living wage rate is subject to annual adjustments. It is imperative to understand that compliance with the current living wage rate is mandatory, irrespective of the year in which the contract was originally awarded. Contractors must ensure their pay rates are updated each year to comply with the Baltimore City Code, Article 5, Subtitle 26. For comprehensive understanding and adherence, a full copy of the City Code, Article 5, Subtitle 26, is available on the City of Baltimore's website at the Baltimore City Wage Commission. Contractors are strongly encouraged to review this document to ensure full compliance with the living wage requirements.

Copies of completed payroll reports with a statement of compliance shall be submitted as follows:
Via Email to WagePayrolls@baltimorecity.gov,
Via Mail to: Wage Commission 7 E. Redwood Street, 9th floor Baltimore, MD 21202 or
Via Fax: (410) 752-3190

If you need additional clarification regarding Article 5, Subtitle 26, please contact the Wage Commission at 410-396-4835.

LIVING WAGE RATES TO BE USED ON THIS PROJECT -- CITY OF BALTIMORE

Attached to this section of the special conditions are the minimum hourly wage rates established by the Board of Estimates to be paid to all classes of laborers, mechanics, or apprentices needed on the projec

SUBTITLE 26
LIVING WAGES FOR WORK UNDER SERVICE CONTRACTS

§ 26-1. Definitions.

(a) *In general.*

In this subtitle, the following terms have the meanings indicated unless the context clearly requires a different meaning.

(b) *Index.*

"Index" means the most recent available figure stated in the publication "Poverty in the United States", published by the Bureau of the Census and updated on an annual basis, which defines the national poverty level for a family of 4.

(c) *Living hourly wage rate.*

"Living hourly wage rate" means the rate established by the Board of Estimates under the formula set forth in § 26-16 of this subtitle, as the minimum hourly wage rate that must be paid a worker employed by a service contractor.

(d) *Person.*

"Person" means any individual, business entity, corporation, partnership, or joint venture.

(e) *Service contract.*

"Service contract" means a contract designated by the Board of Estimates on the recommendation of the City Purchasing Agent as a service contract that is awarded to a service contractor.

(f) *Service contractor.*

"Service contractor" means the person awarded a City service contract and includes all subcontractors of that person.

(g) *Service worker.*

"Service worker" means any non-professional employee of a service contractor, as defined by the Board of Estimates.

(City Code, 1976/83, art. 1, §26A(a).) (Ord. 94-442; Ord. 04-672; Ord. 08-085.)

§ 26-2. Scope of subtitle.

The provisions of this subtitle shall apply exclusively to service contracts and shall not be construed to conflict with Subtitle 25 of this article on Construction Contracts or any provisions on construction contracts as provided in this subtitle.

(City Code, 1976/83, art. 1, §§264(k).) (Ord. 94-442.)

§ 26-3. Workday.

8 hours shall constitute a regular work day for every individual working directly for any service contractor or subcontractor engaged in the performance of a service contract.

(City Code, 1976/83, art. 1, §26A(b)) (Ord. 94-442.)

§ 26-4. Worker classifications.

Employees of service contractors shall be classified as service workers or non-service workers as specifically set forth in the contract, pursuant to the classification schedule established by the Board of Estimates.

(City Code, 1976/83, art. 1, §26A(c).) (Ord. 94-442.)

§ 26-5. Living wages - In general.

(a) *Payment required.*

(1) Every service worker shall be paid not less often than biweekly, and without subsequent deduction or rebate on any account (except payroll deductions as are directed or permitted by law, by a collective bargaining agreement, or by specific written authorization from an employee), the full amount due at the time of payment computed at wage rates not less than the living hourly wage rate established by the Board of Estimates and set forth in the service contract.

(2) A service worker may not be paid less than the amount established by the Board of Estimates for the living hourly wage rate for a service contract.

(b) *Rates to be posted.*

A copy of the living hourly wage rate for the service contract shall be kept posted by the service contractor at the site of the work in a prominent place where it can be easily seen and read by the service workers. At the request of a service worker, a copy shall be given to the service worker within a reasonable period after the request.

(City Code, 1976/83, art. 1, §26A(d)(1).) (Ord. 94-442; Ord. 08-085.)

§ 26-6. Living wages - Overtime.

(a) *Payment required.*

The service contractor shall pay the service worker compensation at the overtime rates established by the Board of Estimates, which shall not be less than 1½ times the regular hourly

rate of pay, for all hours worked in excess of 8 hours in any work day, or 40 hours in any work week.

(b) *How computed.*

Overtime hours, however, shall not be compensated for more than once and overtime shall be paid only on the regular hourly rate of pay and not on the fringe benefits, other personnel costs, or their cash equivalents.

(c) *Exemption for workers receiving commissions.*

(1) No service contractor shall be deemed to have violated subsection (a) of this section by employing any service worker for a workweek or workday in excess of the applicable workweek or workday specified therein, if:

(i) the service worker's regular rate of pay (hourly rate plus commission) is in excess of one and one-half times the living hourly wage rate established by the Board of Estimates, and

(ii) more than half the service worker's compensation for a representative period (not less than one month) represents commissions on goods or services.

(2) In determining the proportion of compensation representing commissions, all earnings resulting from the application of a bona fide commission rate shall be deemed commissions on goods or services without regard to whether the computed commissions exceed the draw or guarantee (as those terms are used in the Federal Fair Labor Standards Act).

(City Code, 1976/83, art. 1, §26A(d)(2)) (Ord. 94-442; Ord. 08-085; Ord. 11-497.)

§ 26-7. Living wages - Sanctions for underpayment.

(a) *$50 per day.*

(1) In the event that any service worker is paid less than the compensation to which the service worker is entitled to under this subtitle, the service contractor shall make restitution to the service worker for the amount due, and shall forfeit and pay to the City a penalty in the amount of $50 per day for each employee so underpaid.

(2) Provided, however, that the penalty shall not be assessed for wage violations to any individual which amount to a total of less than $1 in any payroll period.

(3) Each day's violation shall constitute a separate offense.

(b) *Debarment for multiple offenders.*

On recommendation of the Wage Commission, when a service contractor has paid fines on more than 3 service contracts in a 2-year period, the Board of Estimates may prohibit a service contract vendor from participating in the bid process for up to 3 years.

(City Code, 1976/83, art. 1, §26A(d)(3), (4).) (Ord. 94-442.)

§ 26-8. Living wages - Workers' complaints.

(a) *In general.*

Within 1 year from the date of the incident, any service worker may file a protest in writing with the Wage Commission, objecting to the wages paid for services performed by the service worker on a service contract as being less than the living hourly wage rate for those services.

(b) *Retaliation prohibited.*

(1) A service contractor shall not discharge, reduce the compensation of, or otherwise discriminate against any service worker for making a complaint to the Wage Commission, participating in any of its proceedings, or using any civil remedies.

(2) In such a case, the Wage Commission may, pursuant to similar procedures as provided in Article 11, Subtitle 4 of the Baltimore City Code, as amended, order appropriate restitution and the reinstatement of such employee with back pay to the date of violation.

(City Code, 1976/83, art. 1, §26A(d)(5).) (Ord. 94-442; Ord. 04-672; Ord. 08-085.)

§ 26-9. Required records - In general.

(a) *Contractors to maintain.*

The service contractor shall maintain payrolls and basic records relating thereto during the course of the work and shall preserve them for a period of 3 years thereafter for all service workers working directly upon the service contract.

(b) *Contents.*

The records shall contain:

(1) the name and address of each service worker;

(2) the service worker's classification in accordance with the classifications fixed in the contract;

(3) the number of hours worked each day;

(4) the applicable living hourly wage rate;

(5) the gross wages, deductions made, and actual wages paid;

(6) a copy of the Social Security returns and evidence of their payment;

(7) a record of fringe benefit payments including contributions to approved plans, funds, or programs and any additional cash payments; and

(8) any other data that the Board of Estimates requires from time to time.

(City Code, 1976/83, art. 1, §26A(e)( ).) (Ord. 94-442; Ord. 04-672; Ord. 08-085.)

§26-10. Required records - Project payroll reports.

(a) *Contractor to submit.*

The service contractor shall submit 2 complete copies of the project payrolls and the project payrolls of each subcontractor, consecutively numbered, not later than 14 days from the end of their respective payroll periods, 1 copy to be sent to the contracting agency, the other to the Wage Commission where the same will be available for public inspection during regular business hours.

(b) *Contents.*

The project payrolls shall contain:

(1) the name of the prime service contractor and any subcontractor, if any;

(2) a designation of the project and location;

(3) the name, Social Security Number, and occupation of each employee;

(4) the classification in accordance with the classifications fixed in the contract;

(5) the number of hours worked daily by the service worker at straight time and at overtime and the hourly wage rate for each;

(6) the gross wages paid to the service worker per pay period; and

(7) such other data as may be required by the Board of Estimates from time to time.

(c) *Prime contractor responsible for subcontractors.*

The prime service contractor shall be responsible for the submission of all subcontractors' payrolls covering work performed.

(d) *Signed statement of compliance.*

Each copy of the payroll shall be accompanied by a statement signed by the contractor or the subcontractor, as the case may be, indicating:

(1) that the payroll is correct;

(2) that the wage rates contained therein are not less than those established by the Board of Estimates as set forth in the contract;

(3) that the classification set forth for each service worker conforms with the work that the service worker performed; and

(4) that the service contractor has complied with the provisions of this subtitle.

(City Code, 1976/83, art. 1, 826A(e)(2)) (Ord. 94-442.)

§ 26-11. Required records - Delinquencies.

(a) *Payments may be withheld.*

If the service contractor is delinquent in submitting any payrolls, processing of partial payment estimates may be held in abeyance pending receipt of the payrolls.

(b) *Fines.*

In addition, if the contractor is delinquent in submitting any payroll, the contractor shall forfeit and pay to the City a penalty of $10 for each calendar day that the payroll is late.

(City Code, 1976/83, art. 1, §264(e)(3).) (Ord. 94-442; Ord. 08-084.)

§ 26-12. {Reserved}

§ 26-13. Withholding payments.

(a) *For outstanding obligations.*

The City may withhold or cause to be withheld from the service contractor so much of the accrued payments as may be considered necessary to:

(1) pay the service workers employed by the service contractor the full amount of wages required by the provisions of this subtitle; and

(2) satisfy any liability of any contractor for any penalties as provided herein.

(b) *For failure to post rates.*

The City may also withhold payments from any service contractor who has failed to post and keep posted a copy of the living hourly wage rate, as required by this subtitle, until the default has been corrected.

(City Code, 1976/83, art. 1, §264().) (Ord. 94-442; Ord. 08-085.)

§ 26-14. Investigations.

(a) *Agency to report irregularity.*

It shall be the responsibility of the contracting agency to promptly examine all weekly project payrolls submitted by service contractors working on a service contract for compliance with the provisions of this subtitle and the regulations promulgated in pursuance thereof and to report any irregularities to the Wage Commission.

(b) *Commission to investigate.*

(1) The Wage Commission shall cause investigations to be made as may be necessary to determine whether there has been compliance with the provisions of this subtitle and the regulations promulgated thereunder, and contained in the contract.

(2) The service contractor shall permit representatives of the City to observe work being performed upon the work site, to interview service workers, and to examine the books and records relating to the payrolls on the project being investigated to determine the correctness of classifications and any payment of proper regular and overtime rates as required.

(3) Complaints of alleged violations shall be investigated promptly and statements, written or oral, made by a service worker shall be treated as confidential and shall not be disclosed to the service contractor without the consent of the service worker.

(c) *Subpoenas.*

(D) If necessary for the enforcement of this subtitle, the Wage Commission may issue subpoenas, compel the attendance and testimony of witnesses and the production of books, papers, records, and documents relating to payroll records necessary for hearings, investigations, and proceedings.

(2) Any such subpoena shall be served by the Sheriff of Baltimore City.

(3) In case of disobedience to subpoena, the Wage Commission may apply to a court of appropriate jurisdiction for an order requiring the attendance and testimony of witnesses and the production of books, papers, records, and documents. Said court in case of contumacy or refusal to obey any such subpoena, after notice to the person subpoenaed, and upon finding that the attendance or testimony of such witnesses of the production of such books, papers, records, and documents, as the case may be, is relevant or necessary for such hearings, investigations or proceedings of the Wage Commission, may issue an order requiring the attendance or testimony of such witnesses or the production of such order of court may be punishable by the court as contempt thereof.

(City Code, 1976/83, art. 1, §26A(g)(1), (2).) (Ord. 94-442.)

§ 26-15. Penalties.

(a) *Debarment for 1 year.*

If the Board of Estimates, upon recommendation from the Wage Commission after notice and hearing, determines that any service contractor has failed to pay the living wage rate or has otherwise violated the provisions of this subtitle and that the failure was intentional, no contract may be awarded to that service contractor, or to any person in which that service contractor has an interest until 1 year has elapsed from the date of the determination.

(b) *Criminal penalties.*

(1) And provided, further, that any such intentional violation of the provisions of this subtitle shall be a misdemeanor, punishable upon conviction by a fine of not more than $500.

(2) Proceedings before the Wage Commission shall not be considered a precondition to criminal prosecution under this subtitle.

(City Code, 1976/83, art. 1, §26A(g)(3).) (Ord. 94-442; Ord. 08-085.)

§ 26-16. Establishment of living wage.

(a) *In general.*

The living hourly wage rate shall be as established by Resolution of the Board of Estimates.

(b) *Annual revision.*

(1) By December 15 of each year, the Wage Commission shall recommend to the Board of Estimates a revised living hourly wage rate for the next fiscal year.

(2) This rate shall be based upon the Index and other factors the Commission is authorized to consider.

(c) *Goals.*

The ongoing goal is to achieve a rate that exceeds the poverty level, as defined in the Index.
(City Code, 1976/83, art. 1, §26A(h).) (Ord. 94-442; Ord. 08-085.)

§ 26-17. Goal of 40-hour work week.

As a matter of policy it is a continuing goal to submit bids based on a 40-hour work week for service workers.
(City Code, 1976/83, art. 1, §26A(i).) (Ord. 94-442.)

§ 26-18. Manner of administration.

The Board of Estimates and the Wage Commission shall administer and enforce the provisions of this subtitle in the same manner that the Board of Estimates and the Wage Commission administer and enforce the provisions of Subtitle 25 of this article on Construction Contracts.
(City Code, 1976/83, art. 1, §26A(j).) (Ord. 94-442.)

NOTICE OF LIVING WAGE

All vendors awarded service contracts for certain services In the City of Baltimore are subject to the provisions of the Baltimore City (Living) Wage Law.

NOTICE TO EMPLOYEES:
Under the provisions of the Baltimore CityCode, Article 5, Subtitle 26

YOU MUST BE PAID A LIVING WAGE OF
$13.33 per hour beginning July 1, 2023
$15.38 per hour beginning July 1, 2024

OVERTIME PAY
At least 1 ½ times the regular rate of pay for All hours worked over eight (8) in one workday; All hours worked over forty (40) in one workweek.

The above rates apply to all contractors and subcontractors of Baltimore City service contracts. All contractors are required to comply also with Maryland's minimum wage laws.

Brandon Scott, Mayor

THIS POSTER MUST BE DISPLAYED UNDER PENALTY OF LAW

BALTIMORE CITY WAGE COMMISSION
7 East Redwood Street, 9th Floor
Baltimore, Maryland 21202
(410) 396-4835
wagepayrolls@balimorecity.gov

BALTIMORE CITY OFFICE OF
Equity and Civil Rights

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division
Rev. Dec. 2008

OMB No.: 1235-0008
Expires: 02/28/2018

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐	ADDRESS	
PAYROLL NO. / FOR WEEK ENDING	PROJECT AND LOCATION	PROJECT OR CONTRACT NO.

(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that is will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

SUBTITLE 26A LABOR TRAFFICKING NOTICE REQUIREMENTS

This requirement went into effect on January 24, 2022.
Labor Trafficking - Notice Requirements For the purpose of requiring certain contractors with the City of Baltimore to place a notice regarding the human-trafficking prevention hotline in certain locations; providing that certain contractors may obtain the required human-trafficking notices from the United States Department of Homeland Security's Blue Campaign website; providing for certain penalties; and generally relating to labor trafficking notice requirements for city contractors.

Subtitle 26A is included hereunder;

SUBTITLE 26A
LABOR TRAFFICKING NOTICE REQUIREMENTS

§ 26A-1. Applicability.

The requirements of this subtitle apply to:

(1) construction contracts, including:

(i) contracts in excess of $5,000 made by the Board of Estimates, or on its behalf, with any person, firm, or corporation for the construction, reconstruction, erection, conversion, installation, alteration, repair, maintenance, renovation, razing, demolition, moving, removing, grading, paving, repaving, curbing, filling, excavation, or any other operation or work to be done or performed in, on, upon, or in connection with any building, bridge, viaduct, tunnel, tower, stack, or other structure, airport, land, highway, pier, wharf, sewer, drain, main, conduit, machinery, or mechanical, electrical, or other equipment;

(ii) each and every project approved by the Mayor and City Council on or after January 1, 2021, receiving funds from tax increment financing in excess of $10,000,000 in the aggregate to the extent those funds are used in whole or in part for the construction, reconstruction, erection, conversion, installation, alteration, repair, maintenance, renovation, razing, demolition, moving, removing, grading, paving, repaving, curbing, filling, excavation, or any other operation or work to be done or performed in, on, upon, or in connection with any building, bridge, viaduct, tunnel, tower, stack, or other structure, airport, land, highway, pier, wharf, sewer, drain, main, conduit, machinery, or mechanical, electrical, or other equipment; and

(2) service contracts, as defined in § 26-1(e) of this article.

(Ord. 22-10.)

§ 26A-2. Requirements.

(1) The prime contractor must post a sign that states the following:

"LABOR TRAFFICKING 101

Labor trafficking includes recruiting, harboring, transporting, providing, or obtaining people for forced or coerced labor.

The coercion could be threats directed at the victim or someone else. Labor trafficking is often linked with exploitation of a worker. To learn more, visit www.mdhumantrafficking.org.

If a worker ...

(1) lacks possession of their own identification and travel documents,

(2) lives at their place of work and in isolated conditions,

(3) experiences verbal or physical abuse from their employer or supervisor,

(4) is made to work in unsafe conditions, prevented from taking adequate breaks, or forced to meet daily quotas

... they may be a victim of labor trafficking.

FOR IMMEDIATE ASSISTANCE
CALL THE NATIONAL HUMAN TRAFFICKING HOTLINE

+1 (888) 373-7888 OR TEXT "BEFREE" TO 233733"

(2) The sign must:

(i) be at least 16 by 20 inches in size;

(ii) contain the text required under subsection (1) of this section in English, Spanish, and any other languages required by the federal Voting Rights Act for voting materials in Baltimore City; and

(iii) draw attention to the phone and text numbers of the National Human Trafficking Resource Center Hotline by showing the phone and text numbers in bold type.

(3) The prime contractor may meet the requirements of this section by creating their own signs using a font size of not less than 30 points for the hotline and text numbers and a font size of not less than 12 points for the body text, or using copies of the signs created and made available online by the United States Department of Homeland Security's Blue Campaign website.

(Ord. 22-10.)

§ 26A-3. Sign location.

A copy of the labor trafficking sign required by § 26A-2 {"Requirements"} of this subtitle shall be posted by the contractor at the site of the work in a clear and conspicuous place where it can be easily seen and read by the workers. Example areas include break rooms, locker rooms, cafeterias, and other similar locations.

(Ord. 22-10.)

§ 26A-4. Penalties for failure to post signage.

(a) *In general.*

(1) *Prerequisite to citation.*

A citation under this section may only be issued after the issuance of a written warning and a failure to correct the violation within 30 days of the date of the warning.

(2) *Authorization to issue.*

In addition to any other civil or criminal remedy or enforcement procedure, this subtitle may be enforced by issuance of an environmental citation under City Code Article 1, Subtitle 40.

(b) *Process not exclusive.*

The issuance of a citation to enforce this subtitle does not preclude pursuing any other civil or criminal remedy or enforcement action authorized by law.

(c) *Each day a separate offense.*

Each day a violation continues is a separate offense.

(Ord. 22-10.)

SC-2 DEFINITIONS:

Supplement Standard Specification Section 00 23 00.01 as follows:

1. Design Project Manager - the representative of Department of General Services or the duly authorized representatives.

2. Project Engineer – the representative of the Department of General Services and whose authority is commensurate with that of the Engineer

3. Building Manager - the City's on-site manager of the building(s) involved in this contract.

SC-3 EQUAL OPPORTUNITY COMPLIANCE

Article 5 §29-15 Mandatory nondiscrimination contract clause:

Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, gender identity or expression, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, suppliers, or commercial customers. Contractor shall provide equal opportunity for subcontractors to participate in all of its public sector and private sector subcontracting opportunities, provided that nothing contained in this clause shall prohibit or limit otherwise lawful efforts to remedy the effects of marketplace discrimination that has occurred or is occurring in the marketplace, such as those specified in Article 5, Subtitle 28 of the Baltimore City Code, as amended from time to time. Contractor understands and agrees that violation of this clause is a material breach of the contract and may result in contract termination, debarment, or other sanctions. This clause is not enforceable by or for the benefit of, and creates no obligation to, any third party.

Article 5 §29-16 Contractor bid requirements:

As part of its bid or proposal, Bidder shall provide to the City a list of all instances within the past 5 years where there has been a final adjudicated determination in a legal or administrative proceeding in the State of Maryland that the bidder has discriminated against its subcontractors, suppliers, vendors, or commercial customers on the basis of race, gender religion, national origin, ethnicity, sexual orientation, gender identity or expression, age or disability, and a description of any resulting sanction entered and remedial action taken.

Bidders may submit this document in a separate sealed envelope with the bid documents.

Article 5 §29-17 Contract disclosure requirement:

Upon the City's request, and only after filing a complaint against Contractor pursuant to Article 5, Subtitle 29, of the Baltimore City Code, as amended from time to time, Contractor agrees to provide the City within 60 calendar days, a truthful and complete list of the names of all subcontractors, vendors, and suppliers that Contractor has used in the past 4 years on any of its contracts that were undertaken within the Baltimore City Market Area as defined in Article 5, §28-1(d) of the Baltimore City Code, as amended from time to time, including the total dollar amount paid by Contractor for each subcontract or supply contract. Contractor agrees to fully cooperate in any investigation conducted by the City pursuant to the City's Commercial Non - Discrimination Policy, as contained in Article 5, Subtitle 29, of the Baltimore City Code as amended from time to time. Contractor understands and agrees that violation of this clause is a

material breach of the contract and may result in contract termination, debarment, and other sanctions. Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, gender identity or expression, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, suppliers, or commercial customers. Contractor shall provide equal opportunity for subcontractors to participate in all of its public sector and private sector subcontracting opportunities, provided that nothing contained in this clause shall prohibit or limit otherwise lawful efforts to remedy the effects of marketplace discrimination that has occurred or is occurring in the marketplace, such as those specified in Article 5, Subtitle 28 of the Baltimore City Code, as amended from time to time. Contractor understands and agrees that violation of this clause is a material breach of the contract and may result in contract termination, debarment, or other sanctions. This clause is not enforceable by or for the benefit of and creates no obligation to, any third party.

SC-4 PAYMENTS TO THE CITY

Any payments to the Mayor and City Council or any of its Departments, Agencies, Board or Commissions due under the terms of this Agreement or arising incident thereto, shall be made to the Director of Finance and be mailed or delivered to:

Director of Finance
Abel Wolman Municipal Building
200 Holliday St., Room One
Baltimore, Maryland 21202

SC-5 CONTRACTOR TO EXECUTE REQUIRED DOCUMENTS AND START WORK PROMPTLY

DELETE Standard Specification Section 00 51 00.07 CONTRACTOR TO EXECUTE REQUIRED DOCUMENTS AND START WORK PROMPTLY and

REPLACE it with the following:

The successful Bidder shall promptly execute and submit a formal Contract, all subcontract agreements in accordance with Article 5 Subtitle 28 of the Baltimore City Code, any and all contract documents specified in an Award Letter, the required Bonds, and all insurance policies or certified copies thereof issued in favor of the Mayor and City Council of Baltimore, as provided in the Special Provisions, all of which shall be subject to the approval of the City Solicitor as to form, terms and conditions. Failure to comply with these requirements within thirty (30) calendar days after the Award shall be just cause for the annulment of the Award. It is understood and agreed that in the event of annulment of the Award, the Board of Estimates may require the Bidder to forfeit, to the use of the City, the amount of the certified check deposited with its Proposal, not as penalty, but as liquidated damages. As an alternative remedy, the City may elect to start the running of contract time (without allowing the Contractor to start work) or to pursue any other remedy allowed to the City under the law or equity.

SC-6 NOISY WORK

SUPPLEMENT Standard Specification Section 01 14 23 as follows:

Work creating excessive noise (jack hammering, demolition, etc.) in or near occupied areas must be coordinated with the Building Manager and Project Engineer, and performed at times

which do not unduly disturb surrounding occupied areas, and shall not take place after 7PM or before 7AM, and at no additional cost to the City.

Confirm hours for proposed noisy activity (such as jackhammering concrete) with DGS Project Manager in writing at least 72 hours in advance.

From time to time, Contractor may be asked to temporarily pause noisy work at the request of the Building Manager or Project Engineer if said work is causing a disturbance to city business inside the building. Pauses of noisy work shall not result in modifications to the project schedule or the contract value.

SC-7 MAINTENANCE OF TRAFFIC

SUPPLEMENT Standard Specification Section 01 55 26 with the following:

If violations to Maintenance of Traffic restrictions are not remedied/corrected within twelve (12) hours from the documented notice being given to the Contractor, an appropriate deduction will be made from the Contractor's next Progress Estimate. The deduction will be equal to the daily pro rata share of the Schedule of Values price bid for Maintenance of Traffic, which is determined by the lump sum price bid for Maintenance of Traffic divided by the number of days in the contract, or $200.00 per day, whichever is more, for each day or portion thereof that the deficiencies exist and will continue until the deficiencies are satisfactorily corrected and accepted by the Project Engineer. The amount of money deducted will be a permanent deduction from the Contract and will not be recoverable. Upon satisfactory correction of the deficiencies, payment of the Maintenance of Traffic Schedule of Values item will resume.

SC-8 OVERTIME REIMBURSEMENT

DELETE Paragraph “C.” of the Standard Specification Section 00 73 18 CONTRACTOR’S EXPENSE and

REPLACE it with the following:

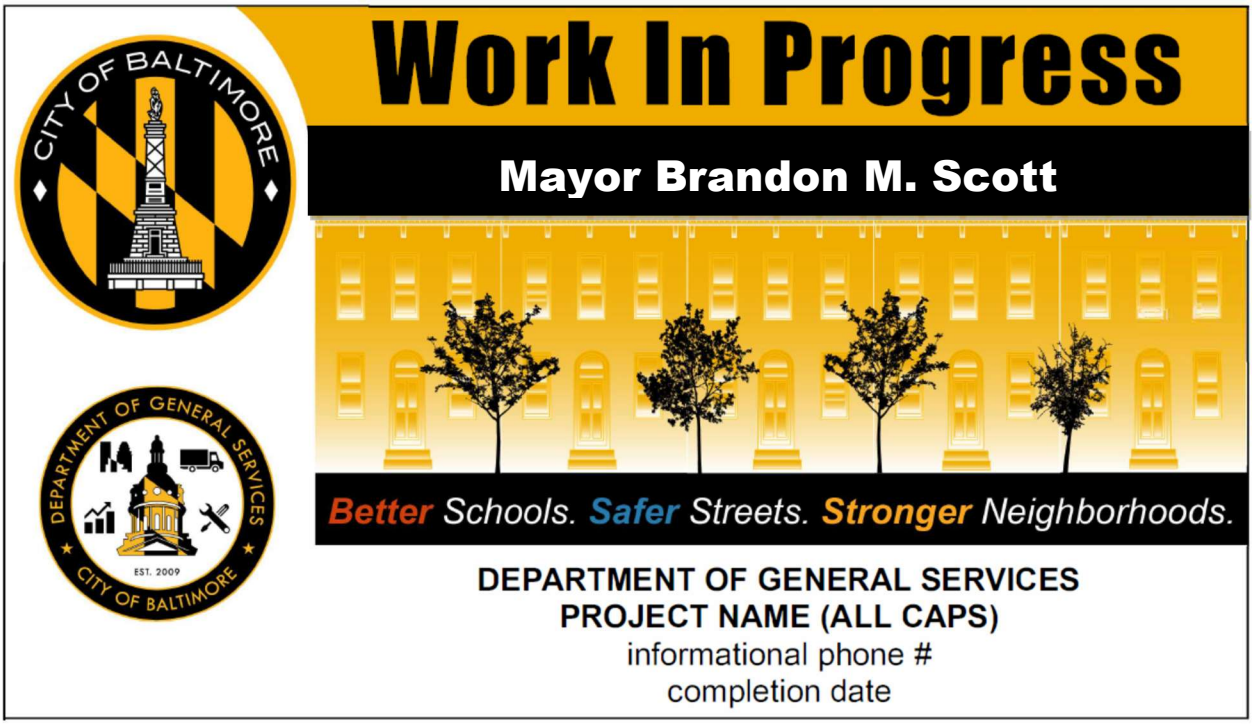
C. The Contractor shall reimburse the City for inspection and all other services required when and if, the Contractor chooses to work in excess of the normal eight (8) hour workday, forty (40) hour work week, weekends, or on a City holiday. The amount due the City shall be deducted from the Contractor’s monthly pay estimate at the hourly rate of one hundred fifty dollars ($150.00). The rate specified is per inspector and/or Building Manager on the project while the overtime work is ongoing. The Contractor should assume that, if one (1) to two (2) crews are working, at least one (1) inspector will be on site. If three (3) to five (5) crews are working, at least two (2) inspectors will be on site. If more than five (5) crews are working, at least three (3) inspectors will be on site. This overtime reimbursement shall not apply to overtime work done at the City’s request due to no fault of Contractor.

SC-9 PROJECT IDENTIFICATION:

SUPPLEMENT Standard Specification Section 01 58 00 PROJECT IDENTIFICATION as follows:

The Contractor shall furnish, install, and maintain project signs using the design shown below and at a location as directed by the Engineer.

The Contractor shall update the completion date on the project signs quarterly until substantial completion.



SC-10 CONTRACTOR PHOTO IDENTIFICATION

The Contractor shall provide a photograph identification badge for each member of his workforce. Each individual shall display the identification badge before entering the project site and as requested during their presence on the project site. The identification badge shall include the individual's photograph, name, organization, and the contract number. Contractor's workforce shall include, but is not limited to, subcontractors, suppliers, manufacturers' representatives, testing agencies, etc. The Contractor shall furnish a photocopy of an individual's identification badge to the Engineer prior to the individual's beginning work at the site. In those instances where the duration of an individual's on-site visit is to be very limited, the Contractor will issue a temporary, non-photo, identification card. The individual may not enter the site until the temporary, non-photo, identification card is issued.

SC-11 CONTRACTOR WORK HOURS

SUPPLEMENT Standard Specifications Section 01 14 18 GENERAL WORK HOURS as follows:

Except otherwise Specified in the Special Provisions or other Contract Documents, or directed by the Engineer, the regular eight (8) hour working day shall begin no earlier than 7:00 A.M. and end no later than 5:00 P.M. Any other working hours must be coordinated with the Engineer and the Building Manager.

SC-12 SUNDAY AND HOLIDAY WORK

DELETE from Paragraph "A." of Section 01 14 21 SUNDAY AND HOLIDAY WORK of the Standard Specification the word "SUNDAY", and

SUBSTITUTE the words "SATURDAY AND SUNDAY".

ADD to Paragraph "B." of Section 01 14 21 SUNDAY AND HOLIDAY WORK of the Standard Specifications the following holidays:

Martin Luther King, Jr. Birthday, Presidents Day, Good Friday, Indigenous Peoples' Day, Veterans Day, and any other holidays or City non-work days as indicated by the Baltimore City Labor Commissioner at
http://labor-commissioner.baltimorecity.gov/official-city-holidays

SC-13 WARRANTIES

DELETE Paragraph A of Standard Specification Section 01 78 36 WARRANTIES

REPLACE it with:

"The Contractor warrants and guarantees to the City all the improvements made for a period of two (2) years after the date of acceptance or occupancy by the City".

SC-14 PROGRESS MEETING DUTIES

The Contractor shall employ and provide a clerk, satisfactory to the Engineer, who shall be available at all times to record minutes of all meetings and send sufficient copies of minutes of the meetings to all interested parties or as directed by the Engineer.

SC-15 ENGINEER'S OFFICE

An ENGINEER'S OFFICE will NOT be required as per Section 13 22 00 of the City of Baltimore, Department of Public Works – Specifications – Materials, Highways, Bridges, Utilities, and Incidental Structures 2006.

SC-16 BUILDER'S RISK

Supplement Standard Specification Section 00 73 16.01 as follows:

Contractor shall have and maintain during the life of the Contract such Property Insurance upon the Contractor's entire work at the site up to the complete value thereof. This insurance shall protect the City, as its interest may appear in the work, and shall insure against the perils of fire and extended coverage, theft vandalism and malicious mischief. All Risk Insurance may not contain exclusions relating to flood, earthquake, mysterious disappearance, hail and terrorism.

If the Property Insurance contains a co-insurance provision, the Contractor shall be responsible for the amount of the insurance satisfying the co-insurance amount so as to make the co-insurance clause inoperable. If not covered otherwise, the Contractor shall have and maintain

during the life of the Contract similar Property Insurance on portions of the work stored off the site or in transit when such portions of the work are to be included in any payment.

SC-17 MATERIALS:

Supplement Standard Specification Section 01 45 14 as follows:

Materials and equipment shall be new, and shall be those of the manufacturers named in the specifications or of a quality, capacity, etc., approved as equal by the Project Engineer.

SC-18 REUSE AND RECYCLING OF SELECTED MATERIALS

The contractor shall include the processing of certain materials to be recycled and/or reused as noted in the Contract Documents.

It is the intention of the City to recycle as much of the materials resulting from New Construction, Restoration, Stabilization and Demolition projects as feasible. The Contractor, therefore, shall be required to source separate certain materials that have recycling potential. These items include but are not limited to: structural steel, concrete, bricks (excluding refractory type), lumber, plaster, plasterboard, insulation cement, roofing materials, floor and wall tiles, pipes, wires and other items physically attached to the structure, including appliances.

MATERIALS MANAGEMENT REPORTING: At each Project Progress Meeting the contractor shall provide spreadsheet (one electronic and one hardcopy) inventory of the following:

- The material type,
- The number of truckloads and/or containers,
- Their overall individual vehicle daily volumes hauled, and
- Individual vehicles “net” payload weights, of all materials intended to be reused, recycled and /or disposed.

DATE						
	Material Type	**Unit of Measure**	**# of Units**	**Total Weight of Day’s Material**	**Total Volume of Day’s Material**	**End Use: Reused / Recycled / Disposed**
1						
2						
3						
4						
5						
6						

7						
8						
9						

SC-19 TERMINATION FOR CONVENIENCE OF THE CITY

A. Performance of work under this Contract may be terminated by the City in accordance with this clause, in whole or in part, whenever the City shall determine that such termination is in the best interest of the City. Any such termination shall be effected by delivery to the Contractor of a written Notice of Termination specifying the extent to which performance of work is terminated and the effective date of termination.

B. After receipt of a Notice of Termination, and except as otherwise directed by the Engineer, the Contractor shall:

1. Stop work under the Contract on the date and to the extent specified in the Notice of Termination;

2. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of the portion of the work under the Contract as is not terminated;

3. Terminate all orders and subcontracts to the extent that they relate to the work terminated by the Notice of Termination;

4. Assign to the City, in the manner, at times, and to the extent directed by the Engineer, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the City shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Engineer, to the extent he may require, which approval or ratification shall be final for all the purposes of this clause;

6. Transfer title and deliver to the City, in the manner, at the times, and to the extent, if any, directed by the Engineer, fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the work terminated by the Notice of Termination, and/or completed or partially completed plans, drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to the City;

7. Use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Engineer, any property of the types referred to in (6) above. The Contractor will not be required to extend credit to any purchaser, and may acquire any such property under the conditions prescribed by and at a price or prices approved by the Engineer; provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the City to the Contractor under this contract or shall otherwise be credited to the price or cost of the work covered by this contract or paid in such other manner as the Engineer may direct;

8. Complete performance of any part of the work that has not been terminated by the Notice of Termination; and

9. Take any action that may be necessary, or as the Engineer may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the City has or may acquire an interest.

10. Submit to the Engineer a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of those items for which the disposition has been directed or authorized by the Engineer. The Contractor may request the City to remove such items or enter into a storage agreement covering them. Not later than fifteen (15) days thereafter, the City shall accept title to these items and remove them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the Engineer upon removal of the items, or if the items are stored, within forty-five (45) days from the date of submission of the list. Any correction to this list shall be made prior to final settlement.

C. After receipt of a Notice of Termination, the Contractor shall submit to the Engineer its termination claim, in the form and with certification prescribed by the Engineer. This claim shall be submitted promptly but in no event later than six (6) months from the effective date of termination, unless one or more extensions in writing are granted by the Engineer upon request of the Contractor made in writing within the six-month period or authorized extension thereof. However, if the Engineer determines that the facts justify such action, he may receive and act upon any such termination claim at any time after the six-month period or any extension thereof. Upon failure of the Contractor to submit his termination claim within the time allowed, the Engineer may determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount so determined.

D. Subject to the provisions of paragraph (C), the Contractor and the Engineer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done; provided, that such agreed

amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. The Contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing in paragraph (E) of this clause, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Engineer to agree upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts that may be agreed upon to be paid to the Contractor pursuant to this paragraph.

E. In the event of the failure of the Contractor and the Engineer to agree as provided in paragraph (D) upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, the Engineer shall pay to the Contractor the amounts determined by the Engineer as follows, but without duplication of any amounts agreed upon in accordance with paragraph (D):

1. With respect to all contract work performed before the effective date of the Notice of Termination, the total (without duplication of any items) of:

    i. the cost of the work;

    ii. the cost of settling and paying claims arising out of the termination of work under subcontracts or orders, as provided in paragraph (B)(5) above, exclusive of amounts paid or payable on account of supplies or materials delivered or services furnished by subcontractors or vendors before the effective date of the Notice of Termination, which amounts shall be included in the costs payable under (i) above; and

    iii. a sum, as profit on (i) above, determined by the Engineer to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this subdivision (iii) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

2. The reasonable cost of the preservation and protection of property, incurred pursuant to paragraph B(8) above, and any other reasonable cost incidental to termination of the work under this Contract, including expenses incidental to the determination of the amount due to the Contractor as the result of the termination of the work under the Contract.

3. The total sum to be paid to the Contractor under (1) of this paragraph shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. Except for normal spoilage, and except to the

extent that the City shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor as provided in (E)(1) above, the fair value, as determined by the Engineer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the City or to a buyer pursuant to paragraph B(7).

F. Costs claimed, agreed to, shall be in accordance with all applicable City, State and local laws, regulations and ordinances.

G. The Contractor shall have the right of appeal, under the clause of the Specifications entitled "Disputes," from any determination made by the Engineer unless the Contractor has failed to submit his claim within the time provided herein and has failed to request and receive a written extension of time in which to submit his claim. In any case where the Engineer has made a determination of the amount due to the Contractor, the City shall pay to the Contractor the following:

1. if there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the Engineer, or

2. if an appeal has been taken, the amount finally determined on such appeal.

H. In arriving at the amount due the Contractor under this clause there shall be deducted

1. all unliquidated advances or other payments made to the Contractor, applicable to the terminated portion of this contract,

2. any claim that the City may have against the Contractor in connection with this contract, and

3. the agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this clause, and not otherwise recovered by or credited to the City.

I. If the termination hereunder is partial, the Contractor may file with the Engineer a claim for an equitable adjustment of the price or prices specified in the contract relating to the continued portion of the contract (the portion not terminated by the Notice of Termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this clause shall be asserted within ninety (90) days from the effective date of the termination notice, unless an extension is granted in writing by the Engineer.

J. The City may from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this

contract whenever in the opinion of the Engineer the aggregate of such payments shall be within the amount to which the Contractor shall be entitled hereunder.

K. Unless otherwise provided for in this Contract, or by applicable statute, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement under this contract, preserve and make available to the City at all reasonable times at the office of the Contractor but without direct charge to the City, all books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this contract and relating to the work terminated hereunder, or, to the extent approved by the Engineer, reproductions thereof.

SC-20 PROJECT MANAGEMENT SOFTWARE

The Contractor shall provide a schedule of deliverables utilizing Professional Project Management software approved by the Engineer. This schedule shall reflect the anticipated activities, time frames, and in work days for the activities listed. Also, the contractor is expected to utilize “Unifier” for submittals, RFIs, invoicing and any other reports and documents as required and directed by the Engineer. The City will provide the license and Training material for Unifier as required.

SC-21 TEMPORARY TOILET ROOM FACILITIES

The Contractor shall provide temporary toilets and wash facilities. Comply with regulations and health codes for type, number location, operation and maintenance of fixtures and facilities.

SC-22 PROJECT SUPERVISION BY THE CONTRACTOR

The Contractor shall have a Superintendent on the premises during all phases and operations of work. The Superintendent shall be English Speaking.

SC-23 MODIFICATION OF SCOPE

Contractors should be aware that the project is not limited to the scope as defined in these bid documents and that Department of General Services & Department of Recreation and Parks reserves the right to modify the scope of work as necessary with a change order.

SC-24 ALTERNATES

DGS reserves the right to complete any Alternate listed in the Schedule of Alternates “IF ANY” as change orders upon availability of funds.

SC-25 TRAFFIC CONTROL PLAN

Contractor shall be responsible for providing a traffic control plan to the Department of Transportation for their approval for any sidewalk or street lane closures required for this contract. The contractor shall be responsible for applying and paying for all required permits.

SC-26 HAZARDOUS MATERIALS (ASBESTOS, LEAD PAINT, PCB's, ETC.)

If in the course of work on this project the Contractor should observe or become aware of material which is believed to be hazardous, whether it impacts the work to be done or not, the Contractor is required to inform the Engineer of such in writing without delay.

SC-27 MONTHLY ESTIMATES AND PAYMENTS

To Section 01 29 76 PROGRESS PAYMENT PROCEDURES of the City of Baltimore, DPW – Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, add:

Pursuant to the City of Baltimore Guidelines for the Performance Evaluation of Design Consultants and Construction Contractors, a Contractor achieving two consecutive "A" evaluations can request that the retainage for the Contract be reduced from 5% to 1.5% at the 50% payment earned (excluding stored material) milestone. The request shall be accompanied by a document from the Surety indicating approval of said reduction. A Contractor shall remain eligible for this reduction in retainage by maintaining an "A" rating. If a subsequent evaluation is less than an "A" rating, 10% monthly retainage shall re-commence until retainage again amounts to 5% of the Contract value. Retainage will not be released until final payment (unless partially released in a semifinal payment). When the amount earned during any one month or period, less the appropriate retained percentage shall be less than Five Hundred Dollars ($500.00), no payment will be made except on the last current estimate, until the total amount earned, less retained percentage, since the last preceding payment is at least Five Hundred Dollars ($500.00). The appropriate retained percentage shall be deducted from each and every estimate made under the entire Contract and shall be retained until final completion of all work covered by the Contract, notwithstanding any provision to the contrary that may appear in the Contract Documents.

Vendors are reminded that under Baltimore City Code Section 28-55, payments for subcontractors must be mailed, delivered, or transferred to subcontractors no later than seven (7) days after a contractor receives payment from the City.

SC-28 PROGRESS SCHEDULE

Replace Section 01 32 16 of the City of Baltimore, DPW – Specifications for Material, Highways, Bridges, Utilities and Incidental Structures, with:

A. Within fifteen (15) days after the award of the Contract, the Contractor shall submit to the Engineer, for approval, a complete progress schedule for the work to be done. The progress schedule shall show the number of locations where work is proposed to be done at the same time, the kind of work so scheduled, and the dates the different kinds of work are scheduled to begin and to be completed. Allowance in the schedule shall be made for normal interruptions to operations due to repairs and maintenance of equipment and delays which are likely to be encountered due to weather conditions and otherwise unforeseen factors. The schedule shall demonstrate that the Contractor will complete the work within the time specified and the Contractor shall give evidence of his ability to carry out the work in accordance with the schedule.

B. The schedule or chart shall be made of reproducible paper. After approval, the Engineer will reproduce two copies of the schedule or chart. One schedule or chart will be

given to the Contractor and shall be retained in his field office and kept up to date by the Contractor's field superintendent. The second schedule or chart will be held in the field office of the Engineer and will be kept up to date by the field representative.

C. If, in the opinion of the Engineer, construction progress has been or will be materially affected by changes in the Plans or in the quantities of work, or **if the Contractor's performance has failed materially to confirm to the** approved schedule, the Contractor shall, upon request by the Engineer, submit a revised schedule of operations for approval. Approval of the Contractor's progress schedules by the Engineer, shall in no way justify the schedules, but simply indicate concurrence in their reasonableness and feasibility on the assumption that the Contractor will make every effort required to meet them. Existence of a current and approved progress schedule shall be a condition precedent to the processing and payment of any partial pay estimate.

NOTE: NO INFORMATION OTHER THAN THAT INCLUDED IN OR ATTACHED TO THIS ORIGINAL BID DOCUMENT (WHERE SUCH ATTACHMENT IS PERMITTED) WILL BE USED IN DETERMINING AWARD.

ORIGINAL (NOT TO BE DETACHED)
NOTICE TO BIDDERS

THE COMPLETE (ORIGINAL) CONTRACT BOOK AND DUPLICATE OF BID OR PROPOSAL MUST BE INCLUDED IN THE BID ENVELOPE

CITY OF BALTIMORE
DEPARTMENT OF GENERAL SERVICES

CONTRACT NUMBER PRJ000889
HARFORD SENIOR RENOVATION & ENVELOPE UPGRADES

C. BID OR PROPOSAL

A. BID PRICES

Proposal of_____

Address _____

Made this _____day of_____ 20_____

Bid Due **WEDNESDAY, AUGUST 5, 2026**

Certified Check or Bank Cashier's Check or Bank Treasurer's Check or Bid Bond: Equal to two percent (2%) of the Total Bid Submitted.

Project Completion Time: **365** consecutive calendar days

Liquidated Damages**: $ 1,500.00** per consecutive calendar day

To the Board of Estimates of Baltimore City:

_____ propose to furnish all necessary labor and materials, tools, implements, tackle, equipment and machinery, and to construct and complete the **PRJ000889 – Harford Senior Renovation & Envelope Upgrades** at **4920 Harford Road, Baltimore, MD 21214**, all in strict accordance with the attached contract documents, at and for the lump sum base bid price of:

A. Harford Senior Renovation & Envelope Upgrades Base Bid:

_____ ($_____)
Written Words Numerical

ALTERNATES

PLEASE REFER TO THE SPECIFICATIONS SECTION 01 23 00 – ALTERNATES

A. ALTERNATE NO. 1: Storefront Replacement and Awning
The Contractor shall provide all labor, material, equipment and services necessary and incidental to the demolition of the existing exterior storefront system and existing awning at the east elevation, the construction of the new exterior storefront system and sun shade devices at the east elevation of the building, and the installation of prefabricated canopy structures with integral lighting and drainage at the east and west entrances.

_____ ($_____)
Written Words Numerical

B. ALTERNATE NO. 2: New Building Identification Sign
The Contractor shall provide all labor, material, equipment and services necessary and incidental to the construction of the new exterior, cast letter building identification signage as indicated on the drawings and in section 10 14 00 – Signage.

_____ ($_____)
Written Words Numerical

Note: In the case of adding alternates to the contract, Contractors are required to maintain the MBE goal of 24% , and the WBE goal of 10% for the total amount of each awarded alternate.

UNIT PRICES

PLEASE REFER TO THE SPECIFICATIONS SECTION 01 22 00 – UNIT PRICES

List of Unit Prices: Provide a cost for each unit price item on the Bid Form.

Unit Price #1: Wood Blocking
The unit price shall represent the total cost to furnish and install 2x8 pressure treated, fire retardant rough lumber blocking at locations that are above and beyond the blocking indicated in the contract documents; and at the direction of the Owner or Owner's Representative. Payment will be made for the actual quantity of material installed measured by the linear foot. Estimated quantity of additional blocking to be included: (50) linear feet.

Per linear foot, $_____

Unit Price #2: Gypsum Deck Repairs
Provide all labor, material, equipment, and services necessary and incidental to replace portions of damaged gypsum decking with new gypsum panels and reinforcing. Payment will be made for the actual quantity of decking repairs measured by the square foot. Estimated quantity of gypsum decking to be included: (50) square feet.

Per square foot, $_____

Unit Price #3: Patch existing concrete slab
Provide all labor, material, equipment, and services necessary and incidental to repair portions of the existing concrete slab with new cast in place concrete and reinforcing.

Payment will be made for the actual quantity of slab repair measured by the square foot. Estimated quantity of concrete slab repair to be included: (50) square feet.

Per square foot, $_____

Basis of Award: To the responsible bidder that submits the bid most advantageous to the City based on the cost and availability to perform the work.

The foregoing price is to include and cover the furnishing of all materials and labor requisite and proper, and the providing of all necessary machinery, tools, apparatus and means for performing the work and the doing of all the above-mentioned work as set forth and described in the Contract Documents.

Note: Each and every person Bidding and Named above must sign here.

In case of Firms, give the first and last name of each member, in full, with Title.

In case a Bid shall be submitted by or in behalf of any Corporation, it must be signed in the name of such Corporation by some authorized Officer or Agent, thereof, who shall also subscribe his Name and Title. If practicable, the Seal of the Corporation shall be affixed.

In case a Bid shall be submitted by joint venture ("JV"), the document that established the JV must be submitted with the bid for verification purposes, and Officers or Agents of all of the firms that are part of the Joint Venture must sign below as acknowledgement of their participation in this bid.

WITNESS_____ (SIGNED) _____

(TITLE) _____

WITNESS_____ (SIGNED) _____

(TITLE) _____

WITNESS_____ (SIGNED) _____

(TITLE) _____

B. BIDDER'S REPRESENTATION

The undersigned bidder certifies that (he/she) has thoroughly examined the site on which the work is to be done, and is thoroughly conversant with all the work called for on the drawings and in all the specifications and with all the requirements necessary and existing to properly execute the work in its entirety; that all allowances have been made for contingencies, etc., for the through, prompt and intelligent execution and completion of the work, within the time required.

_____

Signature and Title

C. RECEIPT OF ADDENDA:

I hereby acknowledge receipt of the following checked Addendum(s) of the Proposal, Duplicate Proposal and/or Plans.

Addendum Numbers 1___ 2____ 3_____ 4_____ 5_____ 6_____ 7_____ 8_____ 9_____ 10____

I understand that failure to confirm the receipt of Addendum(s) may be cause for rejection of bids.

_____

Signature and Title

D. ALTERNATE PRICES:

Attention is directed to the Contract and General Conditions for the Construction, and Division, and Subdivisions which are hereby made a part of the Alternate Prices and which shall apply as fully as if repeated herein.

Consult the drawings and the applicable portions of the Specifications for location and extent. All work shall be subject to all stipulation as set forth in the individual sections of the specifications for the work involved as fully as if repeated herein.

In as much possible, the work that comprises the alternates is defined on the drawings and labeled accordingly. For special conditions that occur between the Base Bid and an Alternate, or between different Alternates, hereinafter described. Should a clarification of intent regarding what is included in a particular Alternate be required, it shall be requested of the DGS Project Engineer in a timely manner prior to receipt of Bids, but in no event later than the date for submission of bid RFIs, otherwise it shall be understood that the Contractor will complete all work covered by the Base Bid and whatever Alternates that are accepted plus whatever coordination or permanent or temporary work that is required to effectively and satisfactorily terminate incomplete construction or service either at the point of juncture with the new work or where directed.

F. BID/PROPOSAL AFFIDAVIT

INSTRUCTIONS: The following Bid/Proposal Affidavit is a material and integral part of this Bid. Each Bidder shall read it carefully and enter all information required therein prior to executing it before a Notary Public. Failure to properly complete and execute this Bid/Proposal Affidavit MAY cause your bid to be found non-responsive and it may be rejected by the Board of Estimates.

1. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the (title) _____ and the duly authorized representative of (business name) _____ and that I possess the legal authority to make this Affidavit on behalf of myself and the business for which I am acting.

2. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business (as is defined in Section 16-101(b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or

performing contracts with public bodies has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, §6-220, Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, **except** as follows (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

_____

_____

3. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or performing contracts with public bodies, has:

(1) Been convicted under state or federal statute of:

(a) A criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or

(b) Fraud, embezzlement, theft, forgery, false pretenses, falsification or destruction of records or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. §1961 et seq., or the Mail Fraud Act, 18 U.S.C. §1341 et seq., for acts in connection with the submission of bids or proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, §14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of a violation of the City of Baltimore's Minority and Women's and Business Enterprises Law, Baltimore City Code, Article 5, Subtitle 28;

(6) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsections (1)—(5) above;

(7) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of bids or proposals for a public or private contract; or

(8) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described in §§B and C(1)—(7) above, **except** as follows (indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the business, and the status of any debarment):

_____

_____

_____

4. AFFIRMATION REGARDING DEBARMENT

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities, including obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, **except** as follows (list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceedings, the name(s) of the person(s) involved and their current positions and responsibilities with the business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension).

_____

_____

_____

_____

5. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland and/or Article 5, Subtitle 40, of the Baltimore City Code; and

(2) The business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, **except** as follows (you must indicate the reasons why the affirmations cannot be given without qualification):

_____

_____

_____

6. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business has:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the bidder or offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted.

7. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, Election Law Article, Title 14, Disclosure By Persons Doing Public Business, Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State of Maryland, including its agencies or a municipal corporation or a political subdivision of the State, during a calendar year in which the person receives in the aggregate $100,000 or more shall file with the State Board of Elections a statement disclosing contributions in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election.

I am aware of, and the above business will comply with all applicable provisions of the Maryland Annotated Code, Election Law Article, §14-101 *et seq*., "Disclosure By Persons Doing Public Business", ("Election Law"). I hereby certify, in accordance with §14-107 of the Election Law, that the above business has filed the statement required under §14-104(b)(1) of the Election Law.

8. CERTIFICATION OF CORPORATION REGISTRATION AND TAX PAYMENT

I FURTHER AFFIRM THAT:

(1) The business named above is a (domestic ___) (foreign __) corporation registered in accordance with the Corporations and Associations Article, Annotated Code of Maryland, and that it is in good standing and has filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation.

(If not applicable, so state). _____

(2) Except as validly contested, the business has paid, or has arranged for payment of, all taxes due the City of Baltimore and the State of Maryland and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, the Department of Labor, Licensing, and Regulation and the City of Baltimore, as applicable.

(3) If awarded the contract resulting from this Bid/Proposal, the business shall remain in full compliance with all requirements of this § 8 during the term, and any extensions thereof, of the said contract.

9. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of the Contract.

10. CERTIFICATION OF WORK CAPACITY AND PREQUALIFICATION CLASSIFICATIONS

I FURTHER AFFIRM THAT:

We hold Certificate No. _____ which expires on _____.

We have the Work Capacity to perform this contract as provided in the Standard Specifications and in accordance with the rules, regulations and requirements of the Baltimore City Contractors' Qualification Committee.
Furthermore, our current Certificate of Prequalification includes work Classifications covering Contract Items to a total of at least Fifty Percent (50%) of the Aggregate Amount Bid.

11. ACKNOWLEDGEMENT

I ACKNOWLEDGE THAT this Affidavit shall be included in my Bid/Proposal and that my failure to furnish it MAY be cause for my Bid/Proposal to be rejected. I further acknowledge that this Affidavit is subject to applicable laws of the United States, the State of Maryland and the City of Baltimore, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this Bid/Proposal shall be construed to supersede, amend, modify or waive, on behalf of the City of Baltimore, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland and Baltimore City with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this Affidavit, (2) the contract, and (3) other Affidavits comprising part of the contract.

I FURTHER ACKNOWLEDGE THAT if the business is awarded the contract resulting from this Bid/Proposal, this Affidavit shall become a material part of the contract and the business agrees that it shall remain in full compliance with all Affirmations contained herin during the term of the contract an any and all extensions thereto.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

By: _____
Name/Title

Subscribed and sworn to me this _____ day of _____ 20___.

_____
Notary Public

My commission expires on _____.

G. MAYOR AND CITY COUNCIL OF BALTIMORE CITY BALTIMORE CITY CODE, ARTICLE 5, SUBTITLE 28 MINORITY AND WOMEN'S BUSINESS PROGRAM

PART A: INSTRUCTIONS

The requirements of Article 5, Subtitle 28 of the Baltimore City Code – Minority and Women's Business Program are a part of the requirements of this contract and are incorporated by reference. The failure of any bidder, contractor or subcontractor to comply with Article 5, Subtitle 28 is subject to any or all of the following penalties: (1) suspension of contract; (2) withholding of funds; (3) rescission of contract based on material breach; (4) refusal to accept a bid; (5) disqualification of a bidder, contractor, or other business from eligibility for providing goods or services to the City for a period not to exceed 2 years; and (6) payment of liquidated damages. Art. 5, §28-122.

All bidders are advised to read all instructions and forms carefully. Please follow the instructions for each section of the forms. **Failure to respond or properly execute the forms can result in disqualification and possible rejection of your bid.**

A complete copy of Article 5, Subtitle 28 of the Baltimore City Code is available online at: https://legislativereference.baltimorecity.gov/city-codes

BID REQUIREMENTS

1. BID REQUIREMENTS

Bids must include a commitment to utilize MBEs and WBEs at a percentage that equals or exceeds the contract goals indicated in the contract specifications. **Bidder must submit the following completed documents WITH THE BID:**

❑ **Part B: Statement of Intent Form(s)** – to be signed by Bidder and MBE and/or WBE.
❑ **Part D: MBE/WBE Participation Affidavit** – to be completed and signed by Bidder **Any bid that does not include a signed Statement of Intent Form(s) and the MBE/WBE Participation Affidavit is non-responsive and will be rejected. MBE/WBE MUST be certified with the City of Baltimore.**

❑ **Part C: Statement of Self-Performance** – to be signed by Bidder who is certified by the City as MBE and/or WBE. This is only filled out if the prime plans to self-perform to fulfill the MBE/WBE goals.
❑ **Part E: MBE/WBE Participation Waiver Request** – to be completed and submitted by Bidder if unable to meet the participation goals. (Please note: Substantial documentation must be provided to justify reasons for not being able to meet goals) Specifically, on Part E numbers one, two, and three must be addressed in detail.

A complete copy of Article 5, Subtitle 28 of the Baltimore City Code is available online at: https://legislativereference.baltimorecity.gov/city-codes

2. **VERIFYING CERTIFICATION**

- Bidder is responsible for verifying that each MBE and WBE to be used on a contract is certified with Baltimore City by the Mayor's Office of Small and Minority Business Advocacy & Development (SMBA&D) at bid opening for the work and/or services to be performed on the contract. Art. 5, §28-48(d).
- The MBEs and WBEs named must be certified for the services they are listed to perform, and the services must be required as part of the Detailed Specifications of the contract.
- A directory of certified MBEs and WBEs is available online at https://baltimorecity.diversitycompliance.com/
- County, State, or Federal certification is not acceptable, the MBE and WBE **must** be certified with the City of Baltimore.

3. COUNTING MBE AND WBE PARTICIPATION

a) Participation of M/WBE's

A business enterprise that is certified as both an MBE and WBE (M/WBE) may not be counted toward both the MBE and WBE goals for the same project. The bidder must select the goal to which the business enterprise is to be counted. Art. 5, §28-31(b) and §28-35.

b) Credit for Self-Performance

A bidder that is an MBE or WBE may count up to 50% of the dollar value of the work it intends to perform with its own (prime) forces toward the applicable MBE or WBE goal. The amount of credit may not exceed the MBE's or WBE's available work capacity as calculated with the Contractor Prequalification rules. **Intentions to count self-performance toward the MBE or WBE goal must be indicated on Part C: Statement of Intent to Self-Perform**. Art. 5, §28-31(d).

c) Commercially Useful Function

The bidder may count toward the contract goals only expenditures to MBEs and WBEs that perform a commercially useful function in the execution of the contract. Commercially useful function means the performance of real and distinct work for which the business enterprise has the skill, expertise, and actual responsibility to perform, manage and supervise. Art. 5, §28-32.

d) Joint Ventures

A bidder may count toward the contract goal the portion of its expenditure to a joint venture that is equal to the percentage of the MBE or WBE participation in the joint venture. The MBE or WBE member of the joint venture must have an interest in the control, management, risks and operation of the joint venture commensurate with the member's percentage of ownership. The MBE or WBE member of the joint venture must be responsible for a clearly defined portion of

the work to be performed, equal to its share in the ownership, control and management of the joint venture. Art. 5, §28-33.

e) Subcontracting by MBE or WBE

A bidder may not count toward its contract goal any agreement with a certified MBE or WBE subcontractor who intends to subcontract more than 10% of the dollar amount of the services to be performed under its agreement with the bidder. This restriction does not apply to an MBE's or WBE's contracts for the purchase of materials, equipment or supplies that are incidental to the performance of services under its agreement with the bidder. Art. 5, §28-34.

f) Manufacturers and Suppliers

Manufacturers – A bidder may count toward the contract goal its entire expenditure to a certified MBE or WBE that manufactures the goods supplied. Art. 5, §28-36.

Non-Manufacturers – **Only 25% of each contract goal may be attained by expenditures to MBEs and WBEs that are non-manufacturing suppliers.** Art. 5, §28-37. *Example:* If the bid amount is $100,000 and the MBE or WBE goal is 15% or $15,000; then the limit for the MBE or WBE suppliers that are non-manufacturers is $3,750 or 25% of the 15% goal.

g) Insurance Companies and Travel Agents

A bidder may count toward the contract goals only the fees or commissions charged by an MBE or WBE insurance company or travel agent. Art. 5, §28-38.

h) Financial Institutions

A bidder may count toward the contract goals only the fees charged and earned by an MBE or WBE financial institution. Art. 5, §28-39.

i) Non-Affiliation

A bidder may not use an MBE or WBE to meet a contract goal if the bidder has a financial interest in, has an interest in the ownership or control of, or is significantly involved in the operation of the MBE or WBE. Art. 5, §28-41.

4. **WAIVER REQUESTS**

If a bidder is unable to comply with a contract goal, the bidder may submit a waiver request with the bid. The waiver request must be made on the MBE/WBE Participation Waiver Request Form. A waiver will not be granted unless the waiver request includes documentation that demonstrates good faith efforts to meet the goals. Art. 5, §28-62.

5. SUBSTITUTION OF MBE OR WBE

The Small and Minority Business Advocacy & Development Office (SMBA&D) must approve the substitution, after the award of a contract, of any MBE or WBE that is included on a bidder's Statement of Intent at the time of bid opening. Any unjustified failure to comply with this requirement after award of a contract is a material breach of contract. Art. 5, §28-63(a).

6. CONTRACT REQUIREMENTS

During the term of the contract, any unjustified failure to comply with the levels of MBE and WBE participation identified in the bid is a material breach of contract. Art. 5, §28-48 (e).

MBE and WBE participation is monitored using the Diversity Management System. You must log in and enter the needed information for each contract.
https://baltimorecity.diversitycompliance.com/

THIS PACKAGE OF MBE AND WBE PARTICIPATION COMMITMENT FORMS, AS DETAILED IN INSTRUCTION 1. BID REQUIREMENTS, ARE DUE WITH THE BID.

BALTIMORE CITY MAYOR'S OFFICE OF
Small and Minority Business
ADVOCACY & DEVELOPMENT

MBE AND WBE BID PARTICIPATION
COMMITMENT FORMS

Name of Bidder (Proposer): _____

Address: _____

Contracting Agency: Department of General Services

Contract (Project) Title: Harford Senior Renovation & Envelope Upgrades

Contract Number: ____PRJ000889_____

Total Value of Bid: $_____

Bid Due Date: _____

PART B:
MBE/WBE AND PRIME CONTRACTOR'S STATEMENT OF INTENT

COMPLETE A SEPARATE FORM FOR EACH MBE and WBE NAMED IN THIS BID. (You are permitted to make additional copies of this form as needed). PART A: INSTRUCTIONS MUST BE REVIEWED BEFORE COMPLETING THIS FORM, WITH PARTICULAR ATTENTION PAID TO SECTIONS 2, 3A and 3F.

Contract Number: _____

Name of Prime Contractor: _____

Name of Baltimore City Certified Subcontractor:
_____

City Certification Number: _____ _____**MBE** _____**WBE**

List the City certified Work and/or Service to be performed by MBE or WBE by NAICS Code:
(The selected MBE and/or WBE above must be City certified for the work/service being performed. Please list each NAICS Code for services to be provided.)
_____

_____

Materials/Supplies to be furnished by MBE or WBE:
_____

Percentage of work to be performed by MBE or WBE: _____**%**

ONLY WHOLE NUMBERS ACCEPTED. NO DECIMALS OR FRACTIONS

The undersigned Prime Contractor and Subcontractor agree to contract for the work/service indicated above for the percentage and corresponding dollar amount listed to meet the MBE/WBE participation goals. This form is subject to the Prime Contractor's execution of a contract with the City of Baltimore. The Subcontractor is currently certified as an MBE or WBE with the City of Baltimore Small and Minority Business Advocacy & Development Office (SMBA&D) to perform the work described above.

_____ _____
Signature of Prime Contractor (REQUIRED) **Date**

_____ _____
Email Address **Phone**

_____ _____
Signature of MBE or WBE (REQUIRED) **Date**

_____ _____
Email Address **Phone**

PLEASE NOTE: CHANGES TO INFORMATION ON PART B: MBE/WBE AND PRIME CONTRACTOR'S STATEMENT OF INTENT THAT ARE MATERIAL TO THE AGREEMENT BETWEEN THE PRIME CONTRACTOR AND MBE OR WBE MUST BE INITIALED BY BOTH PARTIES.

PART C:
STATEMENT OF INTENT TO SELF-PERFORM

PART A: INSTRUCTIONS MUST BE REVIEWED BEFORE COMPLETING THIS FORM, WITH PARTICULAR ATTENTION PAID TO SECTION 2, 3a, 3b and 3f.

Name of Prime Contractor:_____

City Certification Number: _____**MBE** _____ **WBE** _____ **Check one.**

List the City certified Work and/or Service to be self-performed by NAICS Code:
(The Prime Contractor MBE or WBE above must be City certified for the work/service being performed)
Please list each NAICS Code for services to be provided.)

_____

_____

Materials/Supplies to be furnished:

_____

Percentage of Work Prime intends to self-perform as the MBE or WBE: _____**%**

ONLY WHOLE NUMBERS ACCEPTED. NO DECIMALS OR FRACTIONS.

The undersigned Prime Contractor agrees to Self-Perform the Work/Service indicated above for the Percentage indicated to meet the MBE/WBE participation goals, subject to the Prime Contractor's execution of a contract with the City of Baltimore. The Prime Contractor is currently certified as an MBE or WBE with the City of Baltimore Small and Minority Business Advocacy & Development Office (SMBA&D) to perform the work described above.

_____ _____
Signature of Prime Contractor (REQUIRED) **Date**

Email:_____ **Phone:**_____

PART D: MBE/WBE BID PARTICIPATION AFFIDAVIT

The Undersigned authorized representative of Contractor does hereby make the following Affidavit: Contractor has read the Bidder Information and Instructions regarding the MBE/WBE Program. Contractor acknowledges **the MBE goal of 24% and the WBE goal of 10%** for this contract. Contractor has achieved the following participation detailed in the executed Statement of Intent Forms:

MBE _____ %

WBE _____%

ONLY WHOLE NUMBERS ACCEPTED. NO DECIMALS OR FRACTIONS.

My firm has made good faith efforts to achieve the MBE and WBE participation goals for this contract. I understand that, if awarded the contract, my firm must submit to the Small and Minority Business Advocacy & Development Office (SMBA&D) copies of all executed agreements with the MBE and WBE firms being utilized to achieve the participation goals and other requirements of Article 5, Subtitle 28 of the Baltimore City Code. I understand that these documents must be submitted prior to the issuance of a notice to proceed.

I understand that, if awarded the contract, my firm must log all MBE and WBE participation information in the Diversity Management System- https://baltimorecity.diversitycompliance.com/.

I understand that, if awarded this contract and I find that I am unable to utilize the MBEs or WBEs identified in my Statements of Intent, I must substitute other certified MBE and WBE firms to meet the participation goals. I understand that I may not make a substitution until I have obtained the written approval of SMBA&D.

I understand that, if awarded this contract, authorized representatives of the City of Baltimore may examine, from time to time, the books, records and files of my firm to the extent that such material is relevant to a determination of whether my firm is complying with the MBE and WBE participation requirements of this contract.

I do solemnly declare and affirm under the penalty of perjury that the contents of the foregoing Affidavit are true and correct to the best of my knowledge, information, and belief.

_____	_____
Contractor Company Name	Signature
_____	_____
Email Address and Phone	Print Name and Title

PART E: MBE/WBE BID PARTICIPATION WAIVER REQUEST FORM

Name of Bidder _____

Address _____

Contracting Agency: _____

Contract (Project) Number and Title: _____

Bid Due Date: _____

Goals on this contract..... MBE: _____% and WBE: _____%
I have achieved.....MBE: _____% and WBE: _____%
I am requesting a waiver of.....MBE: _____% and WBE: _____%

ONLY WHOLE NUMBERS ACCEPTED. NO DECIMALS OR FRACTIONS.

I have contacted SMBA&D for assistance: _____Yes _____No *(Check One)*

Number of MBE firms contacted: _____ *(Attach a list of names of businesses and detailed efforts taken secure their participation.)*

Number of WBE firms contacted: _____ *(Attach a list of names of businesses and detailed efforts taken to secure their participation.)*

Attach documentation of your good faith efforts to secure, contact and negotiate with MBEs and WBEs, including:

(1) The reasons your company is unable to secure sufficient MBE/WBE participation to meet the stated goals

(2) The efforts made by your company to select portions of the contract to be performed by MBEs and WBEs

(3) For each MBE or WBE that placed a bid that you consider to be unacceptable, a statement that explains the basis for that conclusion

(4) **Please consult the Bidder Information Guide & SMBA&D FAQ for additional waiver guidance.**

_____ _____
Signature of Authorized Company Representative Date

BIDDER SUBMISSION CHECKLIST

- ❑ You have reviewed the **Bidder Information Guide** following this checklist
- ❑ You have viewed the Diversity Management System website- https://baltimorecity.diversitycompliance.com/

— Cover Sheet

- ❑ Include all requested information.
- ❑ You must include the total value of your bid.

— **Part B: Statement of Intent Form(s)**

- ❑ Name of Bidder and Name of MBE or WBE included at the top of the form.
- ❑ Form is signed by both Bidder and MBE or WBE.
- ❑ Form indicates whether the subcontractor is a MBE or WBE.
- ❑ Checked SMBA&D database to verify MBE and WBE certification.
- ❑ Listed the MBE or WBE subcontractor's City certification number.
- ❑ Checked SDAT database to verify good standing of MBE and WBE.
- ❑ Detailed Brief description of work to be provided.
- ❑ Detailed Materials/supplies to be provided (if applicable).
- ❑ Stated Percentage of Work to be performed.
- ❑ The percentages being performed by the MBE and WBE meet the goals set on the bid solicitation.

— **Part D: MBE/WBE Participation Affidavit**

- ❑ The applicable MBE/WBE goal was entered in the first paragraph (this goal should match the goal stated in the bid solicitation).
- ❑ Stated MBE or WBE percentage (%) of work to be performed (this percentage should match the goals set on the bid solicitation).
- ❑ Completed Company name and address.
- ❑ Signed your name.
- ❑ Printed name and title of the person who signed the form.

OPTIONAL FORMS, these should only be submitted if applicable

— **Part C: Statement of Self-Performance**

- ❑ You are certified MBE/WBE by Baltimore City SMBA&D
- ❑ Included the percentage of work to be applied to the applicable MBE or WBE participation goal
- ❑ Self-performing percentage is not over 50% of value of work to be performed by your forces
- ❑ Detailed Brief description of work to be provided
- ❑ Detailed Materials/supplies to be provided (if applicable)

- ❑ Stated Percentage of Work to be self-performed
- ❑ Form is signed by the Bidder

— **Part E: MBE/WBE Participation Waiver Request**

❑ **You submitted an additional document addressing questions one, two and three on Part E.**

- ❑ You exercised good faith efforts to achieve the applicable contract participation goals
- ❑ You reviewed the Bidder Information Guide for guidance regarding waivers and good faith efforts
- ❑ You detailed all efforts that were undertaken to secure MBE and/or WBE participation on this contract in the Waiver Request Form and submitted additional documentation of these efforts.
- ❑ **You have double-checked that all bid forms that will be submitted are complete, contain the required information, and are signed and dated.**

Bidder Information Guide

What are some common mistakes or omissions that I should try to avoid and things to keep in mind?

- Any bid that does not include a signed Statement of Intent Form(s) and the MBE/WBE Participation Affidavit is non-responsive and will be rejected.

- Any Statement of Intent Form(s) and/or MBE/WBE Participation Affidavit that are not properly executed or do not contain all required information will result in a finding of non-compliance and will be rejected.

- **Utilizing a business that is not certified with the City of Baltimore or that has an expired certification, without an extension due to a pending application for renewal, will not count towards meeting a MBE/WBE participation goal.** City Code Article 5, §28-41(d) states that each bidder is responsible for verifying that all MBEs and WBEs to be used have been certified by the Office before bid opening.

- The failure to exercise good faith efforts when requesting a waiver and not meeting the applicable MBE/WBE goals for the contract will result in a finding of non-compliance

- A business enterprise that is Baltimore City certified as both an MBE and WBE (M/WBE) may not be counted toward both the MBE and WBE goals for the same project. The bidder must select the goal to which the business enterprise is to be counted. Art. 5, §28-31(b) and §28-35.

- A bidder that is a City certified MBE/WBE may only count up to 50% of the dollar value of the work it intends to perform with its own forces toward the applicable MBE or WBE goal. The amount of credit may not exceed the MBE/WBE's available work capacity as calculated with the Contractor Prequalification rules. Intentions to count self-performance toward the MBE or WBE goal must be indicated on Part C: Statement of Intent to Self-Perform. A bidder's statement that they will self-perform, but the business is not City certified as a MBE/WBE, may result in the bid being found non-compliant.

- A bidder may count toward the contract goal the portion of its expenditure to a joint venture that is equal to the percentage of the MBE or WBE participation in the joint venture. The MBE or WBE member of the joint venture must have an interest in the control, management, risks and operation of the joint venture commensurate with the member's percentage of ownership. The MBE or WBE member of the joint venture must be responsible for a clearly defined portion of the work to be performed, equal to its share in the ownership, control and management of the joint venture. Art. 5, §28-33.

- A bidder may not count toward its contract goal any agreement with a certified MBE or WBE subcontractor who intends to subcontract more than 10% of the dollar amount of the services to be performed under its agreement with the bidder. This restriction does not apply to an MBE/WBE that contracts for the purchase of materials, equipment or supplies that are incidental to the performance of services under its agreement with the bidder. Art. 5, §28-34.

- A bidder may count toward the contract goal its entire expenditure to a certified MBE or WBE that manufactures the goods supplied. Art. 5, §28-36.

- Only 25% of each contract goal may be attained by expenditures to MBEs and WBEs that are non-manufacturing suppliers. Art. 5, §28-37.

- A bidder may count toward the contract goals only the fees or commissions charged by an MBE or WBE insurance company or travel agent. Art. 5, §28-38.

- A bidder may count toward the contract goals only the fees charged and earned by an MBE or WBE financial institution. Art. 5, §28-39.

- A bidder may not use an MBE or WBE to meet a contract goal if the bidder has a financial interest in, has an interest in the ownership or control of, or is significantly involved in the operation of the MBE or WBE. Art. 5§28-41.

Is there any limitation of what services an MBE/WBE can perform that count towards the contract participation goals?

MBE/WBEs subcontractors must perform a commercially useful function. Commercially useful function is defined in the City Code as the performance of real and distinct work for which the business enterprise has the skill, expertise, and actual responsibility to perform, manage and supervise. Art. 5, §28-32. As a result, the bidder should think broadly and consider all functions and services necessary to fully perform the contract.

Can I get a waiver of the contract participation goals?

If a bidder is unable to comply with a contract goal, the bidder may submit a waiver request with the bid. The waiver request must be made on the MBE/WBE Participation Waiver Request Form. A waiver will not be granted unless the waiver request includes documentation that demonstrates good faith efforts to meet the goals. Art. 5, §28-62. The bidder should have previously consulted the SMBA&D certification directory, https://baltimorecity.diversitycompliance.com/ , and made attempts to secure MBE/WBE subcontractor participation.

Each waiver request **must include documentation** of your good faith efforts to secure, contact and negotiate with MBEs and WBEs, including:

(1) The reasons your company is unable to secure sufficient MBE/WBE participation to meet the stated goals;

(2) The efforts made by your company to select portions of the contract to be performed by MBEs and WBEs; &

(3) For each MBE or WBE that placed a bid that you consider to be unacceptable, a statement that explains the basis for that conclusion.

Each waiver is reviewed individually, highly scrutinized, and will not be granted if the bidder's submission does not evidence that they undertook several steps to secure participation in good faith.

What are "good faith efforts"?

SMBA&D uses the term good faith efforts in several contexts including bid participation forms, waivers, and in evaluating efforts to meet contract participation goals by bidders. All efforts **must** begin with an evaluation of the availability of certified MBE/WBEs to perform the contract services by **consulting the SMBA&D certification directory**:
https://baltimorecity.diversitycompliance.com/
If there are certified MBE/WBEs that can provide the goods or services under the contract the contractor/vendor must undertake efforts to contact those businesses, secure price quotes, and exercise diligence in determining if they have the capabilities and expertise to perform. The availability of MBE/WBEs strongly undercuts any request for participation goals to be waived.

The following are additional examples of actions that can show that efforts were undertaken in good faith to meet the applicable contract goals, including but not limited to:

- The bidder should solicit interest as early in the acquisition process as practicable to allow the MBE/WBEs to respond to the solicitation and submit a timely offer for the subcontract. The bidder should determine with certainty if the MBE/WBEs are interested by taking appropriate steps to follow-up on initial solicitations.

- The bidder should identify portions of the work to be performed by MBE/WBEs in order to increase the likelihood that the MBE/WBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units (for example, smaller tasks or quantities) to facilitate MBE/WBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces. This may include, where possible, establishing flexible timeframes for performance and delivery schedules in a manner that encourages and facilitates MBE/WBE participation.

- The bidder should provide interested MBE/WBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation with their offer for the subcontract.

- A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including MBE/WBEs subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using MBE/WBEs is not sufficient reason for a bidder's failure to meet the contract MBE/WBEs goal, as long as such costs are reasonable and not excessive.

- The bidder should engage in negotiations in good faith with interested MBE/WBEs. It is the bidder's responsibility to make a portion of the work available to MBE/WBEs subcontractors and suppliers and to select those portions of the work or material needed that is consistent with the available MBE/WBEs subcontractors and suppliers, so as to facilitate MBE/WBEs participation.

- Evidence of such negotiation includes: the names, addresses, and telephone numbers of MBE/WBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for MBE/WBEs to perform the work.

- Bidders should include detailed information regarding their attempts to secure participation. SMBA&D cannot accept unsupported statements about efforts to secure MBE/WBE participation. **All waivers must include documentation of those efforts.** For example: you should include email correspondence with subcontractors to show their response or lack of response.

- It is insufficient to simply state that you contacted a business and provide their directory entry or contact information. It is insufficient to make arguments why you believe the goals should be waived and you should be permitted to perform the entire contract with no participation goals. It is insufficient to detail that the contract was previously granted a waiver or that you were previously awarded this contract. A promise to use MBE/WBEs after contract award is not considered to be responsive to the contract solicitation or to constitute good faith efforts. Also, the ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts or to meet the contract MBE/WBE participation goals.

- It is the bidder’s responsibility to establish and document the efforts that were undertaken to secure MBE/WBE participation. **Waivers are judged solely based upon the information provided and detailed to SMBA&D in the bid submission.**

- There are numerous ways to identify subcontractors to participate on the contract such as: the SMBA&D certification directory, https://baltimorecity.diversitycompliance.com/ , attending pre-bid information sessions, business matchmaking meetings and events, advertising and/or written notices, posting of Notices of Sources Sought and/or Requests

for Proposals, and/or written notices or emails to all MBE/WBEs listed in SMBA&D's directory that specialize in the services or goods required to perform the contract.

- MBE/WBEs should not be rejected as unqualified without sound reasons based on a thorough investigation of their capabilities. Factors such as the contractor's standing within their industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union status) are not legitimate causes for the rejection or non-solicitation of bids in the contractor's efforts to meet the project goal.

- Bidders should make reasonable efforts, if needed, to assist interested MBE/WBEs in obtaining bonding, lines of credit, insurance, or related assistance or services as required by the subcontractor.

- Contacting and utilizing the services of available minority/women community organizations; minority/women contractors' groups; local, State, and Federal minority/women business assistance offices (including SMBA&D); and other organizations as allowed on a case-by-case basis to assist in the recruitment and placement of MBE/WBEs. When considering a waiver, you should contact SMBA&D if you feel as though you have exhausted the ability to identify additional MBE/WBEs who could perform on the contract.

SMBA&D will evaluate all of the detailed efforts in determining if the bidder has exercised good faith efforts.

H. MAYOR AND CITY COUNCIL OF BALTIMORE, MARYLAND

THE BALTIMORE APPRENTICE TRAINEE PROGRAM (BATP)

BID FORM

Contracting Agency DEPARTMENT OF GENERAL SERVICES

Contract (Project Title) **PRJ000889 – Harford Senior Renovation & Envelope Upgrades**

Scheduled Bid Due Date: **Wednesday, August 5, 2026**

THIS APPRENTICE TRAINEE FORM IS DUE WITH THE BID.

FOR MORE INFORMATION ABOUT THIS FORM OR ASSISTANCE, CONTACT:

Mayor's Office of Small and Minority Business Advocacy & Development (SMBA&D)
3000 Druid Park Drive
Baltimore, MD 21215
410-396-3818
Christopher Lundy, Chief

SMBA&D (July 1, 2023)

MAYOR AND CITY COUNCIL OF BALTIMORE, MARYLAND

THE BALTIMORE APPRENTICE TRAINEE PROGRAM (BATP)

PART I.

The City of Baltimore has established an Apprenticeship Trainee Program which requires all bidders on City Construction Projects costing $1,000,000.00 dollars or more to participate in an Apprenticeship/OJT Training Program certified by the State of Maryland.

Training and upgrading of minorities and women toward journeyperson status is a primary objective of this Training Provision. The purpose for this objective is to insure a pool of qualified minorities and women to replace those journeypersons who, in the natural course of events will leave the workforce.

The bidder, shall commit to use its best efforts to meet the BATP requirements set forth in these contract documents. If awarded this contract, the bidder shall notify each firm with which the bidder proposes to contract, of the BATP requirements and make these requirements a material part of the subcontract where appropriate.

The bidder hereby designates:

NAME _____

TITLE _____

PHONE # _____

as the person who has been charged by the bidder with the responsibility for carrying out and reporting the bidders compliance with this program.

1. The Bidder shall use its best efforts to comply with the BAT Program requirements set forth in these contract documents. Failure to implement and carry out the BAT Program requirements set forth in these contract documents shall be a material breach of this contract and grounds for termination of the contract.

2. The contractor shall prepare and submit to the contracting agency a plan for apprentice participation together with the construction schedule. The agency engineer shall designate the number of trainees and hours to be utilized and the area in which the trainees are to be required.

A. The draft construction schedule submitted to the contracting agency shall include a copy of the state certified apprentice/ojt program in which the bidder is participating, required labor resources by trade in order to determine the availability of apprentice opportunities, and a trade breakdown of anticipated participation by apprentices. The construction schedule and any updates shall include the apprentice participation by trade.

B. Apprentice participation shall be distributed throughout each technical discipline or trade designated by the engineer.

C. The contracting agency will review and approve the apprenticeship participation plan and forward a copy of the approved plan to SMBA&D.

D. Goals for trainees will be based on the contractor's current utilization (Exhibit I in the contract document) and the availability of minorities and females in specified trade areas as indicated in the publication of the Maryland Department of Labor, Licensing and Regulation, Office of Labor Market Analysis and Information.

E. The specific efforts proposed to be undertaken by the contractor or its subcontractors if additional efforts are required to implement the BAT Program.

F. With each progress payment request, the contractor shall submit a BAT Program Report (AA2A) and a written projection for the following month of Apprentice hourly participation by trade.

G. The BAT Program participation plans shall apply to all change orders and extra work orders.

H. Requests for modifications or amendments of the contractors must be submitted to the contracting agency with copies to SMBA&D.

The contractor will receive a written response to the request.

PART II. AFFIDAVIT

The undersigned, being first duly sworn, on oath states to the City of Baltimore on behalf of the bidder as follows:

1. The bidder gives assurance that it will provide opportunity for training and employment for minorities and women in apprenticeship positions, and other positions whether with the bidder or subcontractors, employed on the project.

2. The bidder gives assurance that it will use its best efforts to comply with the BAT Program.

3. The bidder will maintain records in an easily retrievable and understandable form that will document any and all openings and opportunities for apprentice/trainee and, where appropriate, will make these requirements a part of all subcontract agreements on this project.

4. Bidder acknowledges that any and all bids which fail to include this form duly executed and notarized with the M/WBE portion of the bid documents may be declared as non-responsive by the Baltimore City Board of Estimates.

5. The bidder agrees to submit all forms as required in Part I & III of this document.

_____ _____

Name of Bidder Name of Project Contract

By _____

Title _____ Date _____

I hereby certify that on this _____ day of _____, 20___, before me the subscriber, a Notary Public of the State of _____, in and for _____ _____City or County, personally appeared _____ who acknowledged himself-herself to be the (title) _____ of (company) _____ and being duly authorized, executed the foregoing affidavit for the purposes and uses therein contained.

_____
Signature of Notary Public

_____ (SEAL)
My Appointment Expires

THE BALTIMORE APPRENTICE TRAINEE PROGRAM (BATP)

INSTRUCTIONS

Part III

I. Advertisement for Construction Bids (Contracting Agency)

All bid advertisements for construction projects where the cost is estimated to be $ 1,000,000.00 or more shall include the following language:

"The City of Baltimore has established an apprentice participation program requirement for this contract."

II. Bid Documents

All bid documents where the cost of the bid is estimated to be $1,000,000.00 or more shall include the BATP BID FORM unless otherwise determined by the agency engineer.
The BATP Bid Form Must Be Submitted With the Bid.

III. Pre-Bid Conference

If there is a pre-bid conference, an SMBA&D Compliance Representative shall be present to discuss the BAT Program.

IV. The following forms must be submitted as indicated.

A. The Plan for the Apprenticeship Participation must be completed and submitted for each area of training as designated by the agency engineer before the notice to proceed is issued.

B. The Maryland Apprenticeship Agreement forms must be submitted with each Progress Payment request to the contracting agency or as new trainees are hired.

C. With each progress payment request, the prime contractor must submit the SMBA&D AA2 and AA2A to the contracting agency.

D. If an apprentice is terminated, the contracting agency shall be informed within 10 working days. A new Apprentice Agreement form on the replacement trainee should be attached.

E. SMBA&D forms AA1 and 1A shall be submitted semi-annually on June 30th and December 31st of each year to the contracting agency.

ATTACHMENT

V. Penalties and Sanctions

A. A determination by the Board of Estimates after recommendation by the Small and Minority Business Advocacy & Development (SMBA&D) that the contractor has failed to comply with any portion of the BATP rules as herein provided and described, or its approved apprenticeship plan, shall subject the offending party to any or all of the following:

1. suspension of contract;
2. withholding of funds;
3. rescission of contract based upon a material breach of contract;
4. disqualification of a bidder, contractor for a period of not to exceed two years;
5. payment of liquidated damages.

B. Violation; disqualification. It is a violation of this program to:

1. Willfully falsify, conceal or cover up by a trick, scheme or device a material fact, or make any false, fictitious or fraudulent statements or representations or make use of any false, fictitious or fraudulent statement or entry.
2. Willfully obstruct, impede, or attempt to obstruct or impede any authorized official or employee who is investigating the validity of any activity under the BATP

BALTIMORE APPRENTICE TRAINEE PROGRAM
TRAINEE REVIEW

PROJECT NUMBER: **PRJ000889** DATE:_____
PROJECT NAME: **Harford Senior Renovation & Envelope Upgrades**
CONTRACTOR:

_____

TRAINEE'S SUPERVISOR:_____
CONTRACTOR'S EEO OFFICER:_____

Name	Race	Classification	Rqd. Prog. Hrs.	Actual Training for the Month	Actual Training Hours to Date	Min. Rate	Pres. Rate	Jrnymn. Rate
1.								
2.								
3.								
4.								
5.								
7.								
8.								
9.								

SMBA&D (AA2)
12/00

To Be Submitted With Each
Payout Request by the Subcontractor
to the Prime Contractor

Signed:_____
Date:_____

CITY OF BALTIMORE

SEMI ANNUAL TRAINEE REPORT

ADMINISTRATION CENTER	PERIOD ENDING	LEGEND BA – BLACK AMERICAN AI – AMERICAN INDIAN AA – ASIAN AMERICAN HA – HISPANIC AMERICAN

LINE NO	TRAINING CLASSIFICATION A	NUMBER RECEIVING TRAINING DURING REPORT PERIOD B						NUMBER STARTING TRAINING DURING REPORT PERIOD C						NUMBER COMPLETING TRAINING DURING REPORT PERIOD D						TOTAL HRS OF TRAINING DURING PERIOD
		TOTAL	BA	AA	AI	HA	O	TOTAL	BA	AA	AI	HA	O	TOTAL	BA	AA	AI	HA	O	TOTAL
03	EQUIPMENT OPERATOR																			
04	MECHANICS																			
05	TRUCK DRIVERS																			
06	IRON WORKERS																			
07	CARPENTERS																			
08	CEMENT MASONS																			
09	ELECTRICIANS																			
10	PIPEFITTERS																			
11	PAINTERS																			
12	OTHER SKILLS																			
13	**TOTAL**																			

14	NUMBER OF FEMALES RECEIVING TRAINING		NUMBER OF FEMALES STARTING TRAINING		NUMBER OF FEMALES COMPLETING TRAINING	
NUMBER OF NEW HIRES RECEIVING TRAINING			NUMBER IN APPRENTICESHIP TRAINING		NUMBER OF TERMINATIONS PRIOR TO COMPLETION OF TRAINING	
NUMBER OF UPGRADES RECEIVING TRAINING			NUMBER IN OTHER JOB TRAINING		NUMBER OF PROJECTS UNDER WAY DURING REPORTING PERIOD AND CONTAINING TRAINING SPECIAL PROVISIONS	

COMMENTS:

REPORT PREPARED BY (SIGNATURE) AND TITLE OF CITY OFFICIAL	DATE AA1

CONTRACT NO: PRJ000889 **TRAINEE'S NAME:_____**
PROJECT NAME: Harford Senior Renovation & Envelope Upgrades
START DATE:_____
SUBCONTRACTOR:_____WAGE RATE:_____

MONTH	YEAR		PHASES														
DATE	DAILY TOTAL																
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
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17																	
18																	
19																	
20																	
21																	
MONTHLY TOTAL																	
PREV. TOTAL																	
GRAND TOTAL																	
REQ'D HOURS																	

CERTIFIED CORRECT BY _____DATE:

INSTRUCTOR'S COMMENTS:

_____.
_____.
_____.

DISTRIBUTION: Original Project Engineer:
SMBA&D (AA2A)

REVIEWED BY:
CITY OF BALTIMORE

_____.
SIGNATURE

_____.
DATE

BALTIMORE APPRENTICE TRAINEE PROGRAM CONTRACTOR'S SEMIANNUAL TRAINEE REPORT	PROJECT NO **PRJ000889**
	PROJECT NAME **Harford Senior Renovation & Envelope Upgrades**

INSTRUCTIONS - This report is to be completed by the contractor semiannually for each individual employed on this contract (including any subcontractor under it) who has received training during the reporting period under the training special provisions (a part of the contract proposal). The report is to be submitted by the 10th of the month following the reporting period (July 10, and January 10). The original of this report is to be furnished to the trainer and two copies submitted to the City of Baltimore

1. NAME OF CONTRACTOR NAME OF SUBCONTRACTOR (IF APPLICABLE)		1.A. ADDRESS
2. NAME OF TRAINEE	2A. SEX (check one) ____M ____ F	2.B. ADDRESS
3. AGE OF TRAINEE	4. SOCIAL SECURITY NO.	5. EMPLOYEE STATUS (check one) ____ NEW HIRE ____ UP-GRADE

6. ETHNIC GROUP DESIGNATION (check one)

Black American	Hispanic American	American Indian	Asian American	White
_____	_____	_____	_____	_____

7. SUMMARY OF PREVIOUS TRAINING (ENTER AMOUNT AND TYPE OF TRAINING RECEIVED BY TRAINEE ON OTHER CONTRACTS UNDER APPROVED TRAINING PROGRAMS)

8. JOB CLASSIFICATION OF TRAINEE	9. DATE TRAINING STARTED ON THIS CONTRACT	10. TYPE OF ON THE JOB TRAINING (Check one) _____ Apprenticeship _____ Other

REPORTING PERIODS

INSTRUCTIONS: One vertical column is to be completed for each succeeding reporting period and the form submitted. Enter June 30, Dec. 30, as applicable in

HOURS OF TRAINING DATA								
11. PROVIDED DURING REPORT PERIOD								
12. PROVIDED TO DATE								
13. REMAINING TO COMPLETE THE APPROVED PROGRAM								
14. TERMINATION (IF TRAINING WAS TERMINATED PRIOR TO COMPLETION OF APPROVED PROGRAM EXPLAIN REASON FOR TERMINATION)								
15 REPORT PREPARED BY (SIGNATURE AND TITLE OF CONTRACTOR'S REPRESENTATIVE)						16 DATE		
17 REPORT REVIEWED BY (SIGNATURE AND TITLE OF CITY OF BALTIMORE OFFICIAL						18 DATE		

SMBA&D (1A)

I. BALTIMORE CITY'S YOUTHWORKS PROGRAM

TO: Mayor's Office of Employment Development ("MOED")

FROM: _____

(Legal name of Bidder)

Pursuant to Executive Order, the aforesaid Bidder hereby presents MOED with the following information to assist its outreach efforts for the Baltimore City YouthWorks Program:

Contact Person: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

E-mail address: _____

J. EMPLOY BALTIMORE

Employ Baltimore is designed to create opportunities for businesses that receive municipal contracts to access qualified City residents to meet their workforce needs. The initiative will also ensure that City dollars contribute to the local economy and improve the lives of employable Baltimoreans.

Employ Baltimore meets the business development need by helping employers save time And money in the recruitment process. This service also offers businesses customized training resources that build worker pipelines for hard-to-fill job vacancies, and provides easy access to tax credit programs that support investments in the City's growth. Every year, hundreds of area employers utilize the Mayor's Office of Employment Development's resources to assist their expansion efforts. We look forward to serving you also.

Employ Baltimore

Requirements

1. Complete the *Employ Baltimore* "Certification Statement" contained in the bid document and submit it with your bid package.

2. Contact the Mayor's Office of Employment Development (MOED) within two (2) weeks of receiving the contract award to schedule a meeting. At this meeting MOED will review your workforce/employment plan; explain the employment report requirements and discuss other workforce services available. You will not receive your first payment from the contract until MOED verifies with the contracting city agency that the meeting has been scheduled.

3. Should the workforce plan indicate a need to fill new jobs, the company will agree to post these positions through MOED and its One Stop Career Center network for a period of seven (7) days prior to publicly advertising the openings. This will enable MOED to identify and refer qualified city residents as candidates for these job opportunities.

4. Complete the "Employment Reports" as required on June 30th and December 31st during each year of the contract and at contract completion. Submit "Employment Reports" to:

   Employ Baltimore Mayor's Office of Employment Development
   36 S. Charles Street Baltimore, Maryland 21201
   -or-
   employbaltimore@oedworks.com

   The City will not release a final payment or any retainage held by the City until MOED verifies that the Employment Reports have been submitted.

5. Businesses awarded construction contracts that fully participate in the Employ Baltimore program and comply with the conditions listed in the certification statement may receive an early release or reduction in the retainage fee assigned to the contract.

To Schedule Your Meeting with MOED Please Contact:

Yvette Clark or Katelyn Murphy
Mayor's Office of Employment Development
36 S. Charles Street,
Baltimore, Maryland 21201
Phone 443-984-3014 • Fax 443-220-0510
-or-
employbaltimore@oedworks.com

EMPLOY BALTIMORE
Certification Statement

Contracting City Agency	Bid Number	Award Amount	Award Date
Department of General Services	PRJ000889		

To promote the commitment to utilize ***Employ Baltimore*** to meet employment needs, all businesses awarded contracts, franchises and development opportunities with the City of Baltimore, shall comply with the terms of the Executive Order as described in the bid specification. Under this agreement, contract awardees will complete and submit this certification statement with the bid package.

This Executive Order shall apply to contracts awarded by the City that are in the amounts of $50,000.01 to $300,000.00, except for professional service contracts and emergency contracts.

Additionally, companies awarded construction contracts that fully participate in the ***Employ Baltimore*** program and submit and comply with the certification statement, may receive an early release of or reduction in the retainage fee assigned to the contract.

CERTIFICATION STATEMENT

As a representative of_____ , I_____
(NAME OF COMPANY) (PRINT FIRST AND LAST NAME)

Certify that a company representative will schedule a meeting with the Mayor's Office of Employment Development within two weeks of contract award to review the workforce plan required for this contract.

If there is a need for additional employees, I agree to post the new job openings with MOED's One Stop Career Center Network for seven (7) days prior to publicly advertising these openings. I agree to interview qualified Baltimore City residents referred from MOED. I agree to submit an Employment Report on June 30th and December 31st identifying the total number of workers on this project and total number of Baltimore City residents on payroll during each year of the contract and at the contract completion as a condition of release of the final payment or any retainage due.

Signature: _____ Telephone _____

Title: _____

Email: _____

Company Address: _____

Send to: Yvette Clark
Employ Baltimore-Mayor's Office of Employment Development
36 S. Charles Street
Baltimore, Maryland 21201
Phone 410-545-1603 employbaltimore@baltimorecity.gov

EMPLOY BALTIMORE EMPLOYMENT REPORT

Contracting City Agency	Department of General Services
Bid/Contract Number & Name	PRJ000889 - Harford Senior Renovation & Envelope Upgrades
Contract Start Date	
Contract End Date	

To promote the commitment to utilize the Employ Baltimore Executive Order and to meet workforce needs, all businesses awarded contracts, franchises and development opportunities with the City of Baltimore, shall comply with the terms of the Executive Order as described in the bid package. Under this Executive Order, contract awardees will complete and submit this Employment Report on June 30th and December 31st during each year of the contract and at contract completion. You must identify the number of total workers and the number of Baltimore City residents on payroll for this contract. Also, please indicate any new positions created as a result of the award and filled by Baltimore City residents. Employment Reports should be sent to:

Employ Baltimore
Mayor's Office of Employment Development
36 S. Charles Street
Baltimore, Maryland 21205

- or email –

employbaltimore @baltimorecity.gov

The Employment Report below is hereby submitted by the undersigned for the period: (check one
____ December 31, 20__ _____June 30, 20__ ___ End of Contract – Date_____

Number of total workers on payroll for this contract	
Number of Baltimore City residents on payroll for this contract	
Number of new positions filled by Baltimore City residents	

Vendor/ Company Name: _____

Name: _____

Title: _____

Signature: _____ Date: _____

EMPLOYER SERVICES DIVISION

MAYOR'S OFFICE OF EMPLOYMENT DEVELOPMENT

Mayor's Office of Employment Development
Employer Services

OUR MISSION



We provide workforce solutions, connecting businesses of all sizes with qualified career seekers, and offer complimentary recruitment, training, and retention services. Our mission is to enhance economic justice, strengthen Baltimore City's workforce, and drive economic growth by supporting local employers, ultimately promoting a thriving local economy.

CONTACT US

moed.baltimorecity.gov

business2@baltimorecity.gov

SCAN

"From informational sessions to career fairs, MOED's recruitment efforts have helped us build our local workforce."

Hatzel & Buehler

OUR PARTNERS: Baltimore Development Corporation, BALTIMORE PENINSULA, VISIT BALTIMORE, DOWNTOWN PARTNERSHIP

OUR SERVICES

- No cost job posting, outreach and customized recruitment
- Pre-screening, assessment, and job matching of applicants
- Industry-specific recruitment and retention plans
- Labor market analysis
- Tax credit incentives information
- Layoff aversion and rapid response services
- Connection to state and local government agencies
- Connections to educational and training institutions

TARGET INDUSTRIES

- Healthcare
- Government
- IT/Tech Bioscience
- Business Services (non-profits, educational services)
- Manufacturing
- Warehouse & Logistics

OUR IMPACT

2,338 job placements

4,909 services rendered to businesses

255 businesses serviced

This information pertains exclusively to the Employer Services Division (ESD) for the fiscal year 2024. It does not represent the Mayor's Office of Employment Development (MOED) as a whole.

K. LOCAL HIRING LAW

Rules and Regulations

Title 17 MISCELLANEOUS AGENCIES, BOARDS, AND COMMISSIONS

Subtitle 04 MAYOR'S OFFICE OF EMPLOYMENT DEVELOPMENT

CHAPTER 01 LOCAL HIRING RULES

17.04.01.01.AdoptionandApplicability.

17.04.01.02.Definitions.

17.04.01.03.HiringRules.

17.04.01.04.LocalHiringReviewCommittee.

Subtitle 04 MAYOR'S OFFICE OF EMPLOYMENT DEVELOPMENT

CHAPTER 01 LOCAL HIRING RULES

Authority: City Code Article 5, Subtitle 27

17.04.01.01. Adoption and Applicability.

A. These rules and regulations are promulgated by the Mayor's Office of Employment Development ("MOED") pursuant to City Code Article 5, Subtitle 27.

B. These rules are

(1) applicable to:

(a) every contract for more than $300,000 made by the City, or on its behalf, or

(b) every agreement authorizing assistance valued at more than $5,000,000 to a City-subsidized project; but

(2) not applicable to a contract or an agreement that is made by the City, or on its behalf

(a) in the event of an emergency,

(c) pursuant to Baltimore City Charter Article VI, §11(e)(ii).

17.04.01.02. Definitions.

A. In this chapter, the following terms have the meanings indicated.

B. Terms Defined.

(1) "Beneficiary" means any person who:

(a) has a contract with the City for more than $300,000; or

(b) will benefit from more than $5,000,000 in assistance for a City subsidized project.

(2) “City-subsidized project” means any project for which the City or any of its agents or contractors provides funds, resources, or financial assistance, including:

(a) the sale or transfer of land substantially below its appraised value.

(b) payment in lieu of taxes,

(c) tax increment financing,

(d) grants or loans that equal or exceed 15% of total projected project costs; or

(e) installation or repair of physical infrastructure directly related to the project and with value equal to or exceeding 5% of total projected project costs.

(3) “Good faith effort’ as used in Article 5, §27-6(b)(1) means a set of activities conducted by the contractor, vendor or other person demonstrating multiple outreach efforts to City residents including:

(a) ads in local papers,

(b) paid local job boards,

(c) information to local educational and workforce organizations, and

(d) an objective review and rating of resumes of City residents.

(4) “Local hiring law” means the provisions of Article 5, Subtitle 27 and these regulations.

(5) “MOED” means the Mayor’s Office of Employment Development.

(6) “Person” means:

(a) an individual;

(b) a partnership, firm, association, corporation, or other entity of any kind; or

(c) a receiver, trustee, guardian, personal representative, fiduciary, or representative of any kind.

(7) "Satisfactory special workforce development training or placement arrangement" as used in Article 5, §27-6(b)(3) means a written agreement

(a) with MOED or a recognized workforce partner

(b) for a customized training or on-the-job training opportunity leading to unsubsidized employment.

(8) “Substantially below appraised value” as used in Article 5, §27-1(c)(1) means

(a) the sale or transfer of land

(b) applicable to property that has been approved and sold for an amount below 30% of the appraised value.

17.04.01.03. Hiring Rules.

A. The local hiring law requires compliance by

(1) vendors, contractors and their subcontractors regardless of the subcontractor award amount, and

(2) all persons benefitting from an agreement involving more than $ 5,000,000.00 in assistance for a City subsidized project.

B. The local hiring law applies to the original term of a contract award greater than $300,000.00, and to any contract modification including

(1) an amendment,

(2) a renewal,

(3) extra work or change order, and

(4) a task order.

C. A determination of whether a City subsidized project is subject to the local hiring law shall be made when the City executes an agreement authorizing assistance valued at more than $5,000,000.00.

D. The local hiring law applies to on-call contracts when the cumulative task awards increase to over $300,000.00.

E. Upon the execution of a contract or approval of an agreement for subsidy that is subject to the local hiring law, the involved City agency shall complete a MOED vendor contact form providing contact information for

(1) each vendor or contractor awarded, or

(2) each beneficiary of a qualifying City subsidized project.

F. Upon receipt of the completed form from the City agency MOED will contact the vendor or beneficiary.

G. The section of the Board of Estimates summary form requesting local hiring law applicability shall

(1) be completed for all contracts, and

(2) include vendor contact information, if applicable.

H. The party awarded a contract or the beneficiary of an agreement for subsidy shall work with a representative of MOED to complete an Employment Analysis.

(1) The Employment Analysis shall begin within two weeks of

(a) the contract award,

(b) approval of an agreement for a City subsidized project covered by the law, or

(c) the receipt of a vendor contact form once a contract becomes subject to the local hiring law.

(2) The Employment Analysis shall project total workforce and new hires in the Baltimore area needed to fulfill the contract or agreement.

(3) The Employment Analysis shall include

(a) all information reasonably required by MOED

(b) at a minimum general location, both in and out of the Baltimore area, of all workforce positions required to complete the contract or agreement.

I. Documentation shall be attached to a written waiver request of the 51 percent residency requirement of the local hiring law showing

(1) a good faith effort to comply with the requirement, or

(2) another exception provided under Article 5, § 27-6(b).

17.04.01.04. Local Hiring Review Committee.

A. A Local Hiring Review Committee ("LHRC") shall be established.

B. The composition of the LHRC may include representatives or designees from:

(1) Mayor's Office of Employment Development,

(2) Baltimore City's Procurement Office, Bureau of Purchases,

(3) Baltimore City Department of Transportation,

(4) Baltimore City Department of Public Works,

(5) Baltimore City Law Department,

(6) Baltimore City Department of General Services, and

(7) other attendees may be included at the recommendation of the committee.

C. The primary role of the LHRC is to

(1) review the local hiring process, and

(2) make recommendations to MOED regarding the approval or denial of waiver requests.

D. The LHRC shall recommend to the Board of Estimates potential penalties and debarment for noncompliance by those persons or entities subject to the local hiring law.

E. The LHRC shall meet as needed.

F. MOED shall coordinate the materials to be presented to the LHRC and provide it with administrative staff support.

17.04.01.05. Required Reports.

A. Vendors and others subject to the local hiring law must submit monthly employment reports by the fifth business day of the month for the preceding month.

B. Subcontractors shall submit employment reports for the period of their activity in the contract

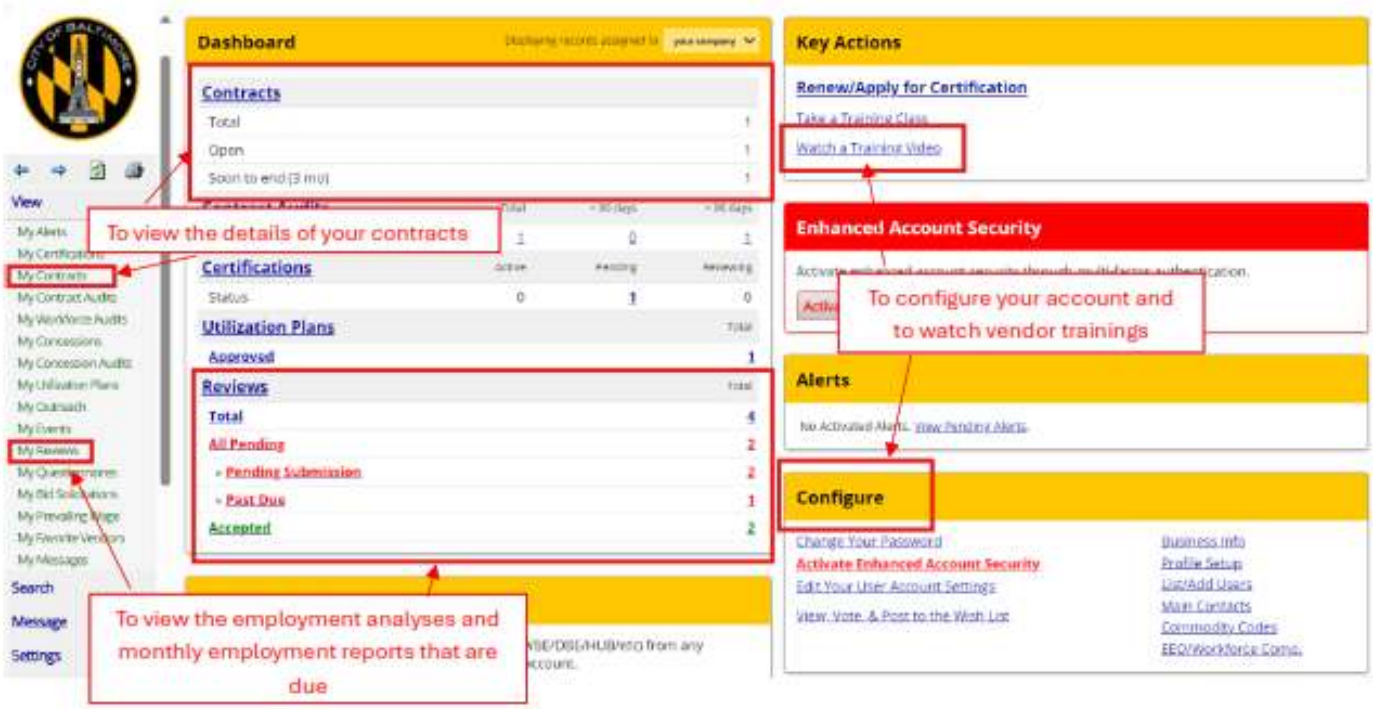
(1) as specified by the start and end date on their signed employment analysis form, and

(2) as confirmed by the prime contractor.

C. City agency directors will be notified of persons or entities subject to the local hiring law that are not in compliance with the law's requirements.

D. Persons or entities subject to the law who remain noncompliant will be reported to the LHRC.

Vendor Guide for B2Gnow and Samples for: Employment Analysis Form, Monthly Report Form, and Add Employee



In your Vendor Profile (Click "My Contracts" or "Business Info")

- Change your business information, addresses, or contact person(s)
- Add employees to your profile (required for **new hires** **only working on city contracts** subject to local hiring)

On your Contract Profile

- Access contract information and change your contact person for the contract
- Access your reviews (employment analyses and monthly employment reports)
- View or change subcontractors/subgrantees/subrecipients
- "Workforce Employee List" to go to your vendor profile to add employees or assign employees to contracts (required for **new hires** **only working on city contracts** subject to local hiring)

Reviews

- Employment reports: generated by the first business day of the month. **Do not check for them early!** Not required after your contract end date.
- Employment analyses: do once per contract, look for guidance from our local hiring coordinator for filling out. Reminders sent after two weeks.

Local Hiring in B2Gnow

Employment Analyses

Once per contract, to project workforce needs

Where to find:

These are labeled employment analyses and are found in the **Reviews** section of contacts and your home page along with monthly employment reports. They should generally be completed with the guidance of the MOED local hiring coordinator, especially if you are unfamiliar with filling these documents out in the past.

Click "Edit," under the actions, to complete.

Fields:

1. Total number of employees on payroll = what is your approximate company size by employee count? Rounding or estimations are acceptable.
2. Total number of workers required to complete this project for the Company/Contractor = For your company specifically, not including subcontractors, how many people are expected to be needed to complete the work on this city contract?
3. Total number of workers required to complete this project for the subcontractors = Put zero if you are not subcontracting work. The total number of workers expected to be needed to complete this project from subcontractors.
4. Does the company require recruitment for new hires on this project? = Will there be job openings related to this contract or is it being performed entirely by your existing workforce? If yes, how soon? If no, briefly in one sentence explain why not.
5. Does your company have other local openings in the Baltimore area? = Do you have other hiring opportunities in the Baltimore area that MOED could assist with recruiting for (for free!).
6. If you're subcontracting work on the project: Check the sub tab of your contract profile (save as draft and exit if necessary). Confirm that the list is accurate and then return to finish the subcontractor question.
7. Attachment: if you have openings to send to MOED, either for the contract or other openings in the Baltimore area, go ahead and download the hyperlinked MOED job posting template and attach that to the employment analysis here.



Local Hiring in B2Gnow

Monthly Employment Reports

If your contact is already set up in B2Gnow, these will be generated to be completed each month

Where to find:

These are labeled monthly employment reports and are found in the **Reviews** section of contacts and your home page along with employment analyses. They will not appear ahead of time, please check back at the beginning of each month to fill out for the reporting period (the full previous month).

Click "Edit," under the actions, to complete.

Fields:

Pay attention to the "**Employment Report Instructions**" at the top of the form and help text on fields.

Reporting period = If you are filling out a report generated at the beginning of January 2025, the reporting period is December 2024. To keep formatting consistent, we have made this a date selection field, so select or type in a day in December 2024 (e.g. 12/1/2024). **All below information will be for activity during that month, for the work on the contract.**

1. How many workers from your company specifically, not subcontractors, worked on this contact during that month.
2. How many of those workers were Baltimore City residents? *This is not held to any percentage requirement.*
3. How many existing workers in your company did you assign to this project? This would be expected to be highest in the month you started work on the contract and might be zero for the rest of the contract. This number plus hires should add up to how many workers are on the contract.
4. How many new job openings were created this month for the contract. **Unless you have a waiver, you should be contacting MOED with these. This report should not be the first we hear about new job openings.**
5. How many of those job openings were listed with MOED? Unless you have a waiver, there shouldn't be a reason this isn't the same as number 4.
6. How many new hires this month for the contract? **You need to enter in the employee's information and assign them to the contract.**
7. How many of those new hires from question 6 were Baltimore City residents? This number can't be higher than your answer to question 6.

Local Hiring in B2Gnow

Entering New Hire Information

If you reported that you hired workers for the contract and you do not have a waiver for hiring locally:

We need the address and other required information on new hires for city contracts. They need to be added to your vendor profile once and then can be assigned to contracts as needed.

Where to find:

In the vendor profile, "Employees" tab. On the contract profile, "Workforce Employee List" and then "Manage Employees" button. Add all the new hires you've hired for city contracts only once, and then assign them as needed to contracts according to how many new hires you've reported on your monthly employment report.

Fields:

In "Add Employee" (Only Once per Worker)

1. Employee Information: First name; Last name; Active employee; SSN (Social Security Number, at least last four digits); Position (job title). Skip other fields.
2. Additional Information: Date state; Pay rate (basic or standard); Skip down to the local hiring fields marked with a red star – Referral source, Highest education level completed, Benefits offered, Hours per week, Date posted with MOED (if applicable), Application date. You may leave comments in Notes or attach supporting files if desired.
3. Work contact information: skip
4. Home contact information: Fill out address, city, state, and zip code.
5. Apprentice information: not used, skip
6. Insurance information: not used, skip

Save.

In "Assign Employee to Contract" (in Contract's Workforce Employee List Tab)

1. Select employee(s) in drop-down list (if not found, see "Add Employee" above)
2. In "Craft", select the only option, "New Hire."
3. Start date on contract – *should be in the reporting period*
4. **All other fields are optional**

Save

SAMPLE 1 - EMPLOYMENT ANALYSIS

Contract Review: Edit Review

CLOSE WINDOW

Please complete all required fields. Required fields are denoted by a red asterisk.

* required entry

Review

NAME	**LOCAL HIRING EMPLOYMENT ANALYSIS (ONE-TIME)**	
DESCRIPTION	**One-time projection of workforce needs completed with the assistance of the local hiring coordinator when being added to a contract**	
CATEGORY	**Contract**	
CONTRACT NUMBER	**1234567**	
REFERENCE	**TESTING CONTRACT**	
CONTRACTOR	***Test Vendor***	
STATUS	**Incomplete**	
CREATED	**2/20/2026 by Joseph Kim**	
DUE	**3/6/2026**	**Access view page to change date** **Last Reminder: 2/20/2026** **# Reminders: 1**
LOCK DATE	**5/20/2026**	**Access view page to change date**
ACCESS RULE	**Vendor**	**Access view page to change setting**
SEND VENDOR NOTICES	**Yes**	**Access view page to change setting**

Please estimate/project these numbers to the best of your ability at this phase of the project.

Workforce Information

Total number of employees on payroll *

The value must be a number

Total number of workers required to complete this project for the Company/Contractor *

The value must be a number

Total number of workers required to complete this project for the subcontractors *

The value must be a number

Total number of new workers required/projected for this project *

The value must be a number

Total number of positions to be posted with MOED *

The value must be a number

Does the company require recruitment for new hires on this project? *

- ◯ No
  - If no, explain
- ◯ Yes
  - If yes, provide how soon in # of days

Attach job posting to the attachments in 'Additional Information' below

Does your company have other local openings in the Baltimore area? *

MOED is happy to assist with recruitment on any local job openings for free!

- ◯ No
- ◯ Yes
  - Provide Location

Attach job posting to the attachments in 'Additional Information' below

Subcontractor Information

Will this company be utilizing subcontractors on this project? *

Subcontractors will be required to complete this form.

- ◯ No
- ◯ Yes

Have you verified that all (if any) subcontractors are in the subcontractor list on this contract? *

- ◯ Yes

○ No

Additional Information

ATTACH FILE(S) Attach File

COMMENTS

Save Draft Save Cancel

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SAMPLE 2 - MONTHLY REPORTS

B2Gnow

Contract Review: Edit Review

CLOSE WINDOW

The City of Baltimore Local Hiring Law Section 27-8 requires businesses to complete and submit this Employment Report by the 5th business day of each month for the duration of the City contract award or city-subsidized project. Intentional violation of any provision of the Law may result in disbarment and/or criminal penalties.

* required entry

Review

NAME	**LOCAL HIRING MONTHLY EMPLOYMENT REPORT**	
DESCRIPTION	**Local Hiring report to be completed and submitted by the 5th business day of each month. *for the previous month (e.g. report 11/1 to 11/30/2024 data between 12/1 and 12/6/2024)***	
CATEGORY	**Contract**	
CONTRACT NUMBER	**1234567**	
REFERENCE	**TESTING CONTRACT**	
CONTRACTOR	***Test Vendor***	
STATUS	**Incomplete**	
CREATED	**2/20/2026 by Joseph Kim**	
DUE	**3/22/2026**	**Access view page to change date** **Last Reminder: 2/20/2026** **# Reminders: 1**
LOCK DATE	**4/20/2026**	**Access view page to change date**
ACCESS RULE	**Vendor**	**Access view page to change setting**
SEND VENDOR NOTICES	**Yes**	**Access view page to change setting**

Reporting Period

Reporting Period: *

Select the first day of the reporting month. Example: 05/01/2024 "Reporting month" covers the full previous calendar month. Example 5/1 to 5/31/2024.

Employment Report Instructions

1. Please indicate the # of workers on payroll for this project (this month).
2. Please indicate the # of City residents on payroll for this project (this month).
3. Please indicate the # of workers transferred from other projects – not newly hired – to work on this project this month.
4. Please indicate the # of new job openings created for this project this month.

5. Please indicate the # of openings posted with MOED this month.
6. Please indicate the # of new employees hired this month.
7. Please indicate the # of Baltimore City residents hired this month.

Workforce Activity

1. Employees needed/on payroll for the contract *

Include at least one for the contract administrator

2. Baltimore City Residents on Payroll for this contract *

3. Current employees transferred from other projects to work on this contract *

4. New job openings created *

5. Job openings listed with MOED *

6. Total of all new employees hired this month *

Please also complete employee information form in B2G

7. Total Baltimore City Residents hired this month *

Additional Information

ATTACH FILE(S) Attach File

COMMENTS

Save Draft Save Cancel

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Vendor Profile: Edit Employee

SAMPLE 3 - ADD EMPLOYEE

General | Public Profile | Business Highlights | Users | Commodity Codes | Contacts & Owners | Employees | Comments | Certifications | Contracts | Site Visits | Docs | Reports

Test Vendor

System Vendor Number: **21135739**

Mark As Favorite

Save | Save and Return | Save and New | Cancel | Delete

* required entry

Employee Information

EMPLOYEE NAME *	Prefix	First name *	Middle name	Last name *	Suffix
REFERENCE					
ACTIVE EMPLOYEE *	(•) Yes ( ) No				
SSN					
EMPLOYEE NUMBER					
POSITION					
GENERAL WORK CATEGORY					

Additional Information

DATE START	mm/dd/yyyy				
DATE TERMINATED/RETIRED	mm/dd/yyyy				
GENDER	None selected				
ETHNICITY	None selected				
EXEMPTIONS					
PAY RATE	Basic	Fringes	Standard	Overtime	Doubletime
	$	$	$	$	$
OWNER/OPERATOR	☐				

DRIVERS LICENSE NUMBER

LICENSES

CERTIFICATIONS

REFERRAL SOURCE* None selected

HIGHEST EDUCATION LEVEL COMPLETED* None selected

BENEFITS OFFERED?* None selected

HOURS PER WEEK*
enter number between 0-100. Example: Full time salaried employees enter 40

DATE JOB POSTED WITH MOED mm/dd/yyyy

APPLICATION DATE* mm/dd/yyyy

ATTACHED FILE(S) Attach File

NOTES

Work Contact Information

ADDRESS 1234 Test Dr, phoenix, AZ 86004

PHONE NUMBER Ext.

MOBILE NUMBER

FAX NUMBER

EMAIL

Home Contact Information

ADDRESS Enter a location

CITY

STATE

ZIP CODE -

PHONE NUMBER

MOBILE NUMBER

FAX NUMBER

EMAIL

Apprentice Information

APPRENTICE

APPRENTICE ID

RATE PERCENT

PERIOD LEVEL

EMAIL

REGISTRATION DATE mm/dd/yyyy

APPROVAL DATE mm/dd/yyyy

EXPIRE DATE mm/dd/yyyy

APPROVED BY

Insurance Information

HEALTH BENEFIT PROVIDER/ORGANIZATION

PROVIDER PHONE NUMBER	
GROUP NUMBER OR PAYOR ID	
INSURANCE ID OR POLICY NUMBER	
EMPLOYER CONTRIBUTION	$
EMPLOYEE CONTRIBUTION	$
COVERAGE START DATE	mm/dd/yyyy
COVERAGE END DATE	mm/dd/yyyy

Save | Save and Return | Save and New | Cancel | Delete

Help Center
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L. BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____

_____

as Principal, and _____

as Surety, are hereby held and firmly bound unto the Mayor and City Council of Baltimore as Owner, in the amount of at least Two Percent (2%) of the Total Bid submitted for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, personal representatives, successors and assigns. Signed this

_____day of _____, 20_____.

The condition of the above obligation is such that WHEREAS the Principal has submitted to the Board of Estimates of the Mayor and City Council of Baltimore a certain Bid, attached hereto, and hereby made a part hereof to enter into a Contract, in writing, for **CONTRACT NO. PRJ000889 – Harford Senior Renovation & Envelope Upgrades**

NOW, THEREFORE,

(a) If said Bid shall be rejected or in the alternate.

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the form of Contract attached here to (properly completed in accordance with said Bid), and shall furnish a bond for his faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith and shall in all other respects perform the Agreement created by the acceptance of said bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event, exceed the penal amount of this obligation, as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their Hand and Seals, and such of them as are Corporation have caused their Corporate Seals to be hereto affixed and these presents to be signed by their proper Officers, the day and year first set forth above.

ATTEST:

PRINCIPAL

Signature

Signature

Print Name/Title (SEAL)

ATTEST:

SURETY

Signature

Signature

Print Name/Title (SEAL)

D. AGREEMENT

THIS AGREEMENT, made this _____ Day of _____

in the year 20___, by and between _____

hereinafter called the "Contractor", and the Mayor and City Council of Baltimore, a Municipal Corporation, hereinafter called the "City", for Contract No. **PRJ000889 - Harford Senior Renovation & Envelope Upgrades**

WHEREAS, the Contract designated as to be performed in strict accordance with the Contract Documents, which Standard Specifications, Plans and other Contract Documents are in all respects made a part hereof, has recently been awarded to the Contractor by the City, through the Agency of its Board of Estimates, at and for a sum equal to the aggregate cost of the work, labor, materials and supplies done or furnished at the prices and rates respectively named therefore in the Proposal attached hereto; and

WHEREAS, it was one of the conditions of said award that a formal Contract should be executed by and between the Contractor and the City evidencing the terms of said award.

NOW, THEREFORE, THIS AGREEMENT WITNESSETH, That the Contractor doth hereby covenant and agree with the City that it will well and faithfully construct, and complete the said Work in accordance with each and every one of the conditions, covenants, stipulations, terms and provisions contained in the Contract Documents, at and for a sum equal to the aggregate cost of the work, labor, materials and supplies done or furnished at the prices and rates respectively named therefore in the Proposal attached hereto, and will well and faithfully comply with and conform to each and every obligation imposed upon it by the Contract Documents, or by the terms of said award. Time is of the essence of this Agreement.

And the City doth hereby covenant and agree with the Contractor that it will pay the Contractor, when due and payable under the terms of the Contract Documents and of said award, the above mentioned sum; and that it will well and faithfully comply with and perform each and every obligation imposed upon it by the Contract Documents or by the terms of said award.

In WITNESS WHEREOF, Said_____
has caused this Agreement to be signed in its name by its President/Vice President and its Corporate Seal to be hereunto and duly attached and the City has caused these presents to be signed by the Mayor of Baltimore City and the Corporate Seal of the City to be hereunto affixed, duly attested by the Custodian of the City Seal.

ATTEST:

SIGNATURE	SIGNATURE (SEAL)
	PRINT NAME AND TITLE (SEAL)
ATTEST:	Mayor and City Council of Baltimore
Custodian of the City Seal	By: BRANDON M. SCOTT, MAYOR

APPROVAL OF AGREEMENT
FOR
DEPARTMENT OF GENERAL SERVICES
CONTRACT NO. **PRJ000889**

APPROVED AS TO FORM AND LEGAL SUFFICIENCY:	APPROVED
Chief Solicitor	Director of General Services
APPROVED:	APPROVED BY BOARD OF ESTIMATES:
Chief, Capital Projects Division	Clerk Date

E. BONDS
PERFORMANCE BOND

Principal	Business Address of Principal
Surety a Corporation of the State of and authorized to do business in the State of Maryland	Obligee Mayor and City Council of Baltimore

Sum of Bond (Equal to Contract Price)
SUM OF _____Dollars
($)

Contract Number and Identification City of Baltimore Department of General Services Contract No. **PRJ000889 - Harford Senior Renovation & Envelope Upgrades**	Date of Contract _____, 2026 Date Bond Executed _____, 2026

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL above named and SURETY above named, are held and firmly bound unto the OBLIGEE above named in the full and just sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, personal representatives, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the PRINCIPAL is entering into a certain Contract with the OBLIGEE described and dated, as shown above and attached hereto, and is required under the Provisions of the Public General Laws of Maryland to give a bond conditioned as hereinafter set forth.

NOW THEREFORE, if the PRINCIPAL shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the OBLIGEE, with or without notice to the SURETY, and during the term or terms of any maintenance, repair, guaranty and warranty required under the Contract, and

PERFORMANCE BOND

shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, and shall indemnify and save harmless the Mayor and City Council of Baltimore, its agents and employees against and from all costs, expenses, damages, injury or loss to which the said Mayor and City Council of Baltimore, its agents and employees, may be subjected by reason of any wrongdoing, misconduct, want of care or skill, negligence or default on the part of said PRINCIPAL, its agents or employees, or in any manner arising directly or indirectly from any and all causes whatsoever, in or about the execution or performance of the Contract, during the Original term of said Contract and/or any authorized extension or modification thereof and/or during the term or terms of any maintenance, repair, guaranty and warranty required under the Contract, then this obligation shall be null and void; otherwise to remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the OBLIGEE, or the successors or assigns of OBLIGEE.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several Seals on the date indicated above, the Name and corporation seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

ATTEST: as to principal

SIGNATURE	SIGNATURE
PRINT NAME	PRINT NAME AND TITLE (SEAL)

ATTEST: as to surety

SIGNATURE	SIGNATURE
PRINT NAME	PRINT NAME AND TITLE (SEAL)

AGENT (COMPANY): _____

AUTHORIZED BY: _____
NAME AND TITLE

PERFORMANCE BOND

APPROVED:

_____
Mayor of Baltimore City

_____
Comptroller

APPROVED AS TO FORM AND
LEGAL SUFFICIENCY:

_____
Chief Solicitor

APPROVED:

_____
Director of General Services

_____
Chief, Capital Projects Division
Department of General Services

APPROVED BY BOARD OF ESTIMATES:

_____
Clerk Date

PAYMENT BOND

Principal	Business Address of Principal
Surety a Corporation of the State of and authorized to do business in the State of Maryland	Obligee Mayor and City Council of Baltimore

Sum of Bond (Equal to Contract Price)
SUM OF _____ Dollars
($)

Contract Number and Identification City of Baltimore Department of General Services Contract No. **PRJ000889 - Harford Senior Renovation & Envelope Upgrades**	Date of Contract _____, 2026 Date Bond Executed _____, 2026

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL above named and SURETY above named, are held and firmly bound unto the OBLIGEE above named in the full and just sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, personal representatives, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the PRINCIPAL is entering into a certain Contract with the OBLIGEE described and dated, as shown above and attached hereto, and is required under the Provisions of the Public General Laws of Maryland to give a bond conditioned as hereinafter set forth.

NOW THEREFORE, the condition of this obligation is such that if the PRINCIPAL shall promptly make payments to all persons supplying labor and/or material in the prosecution of the work provided for in said Contract and any and all duly authorized extensions and/or modifications of said contract that may hereafter be made, notice of such extensions and/or modifications to the SURETY being hereby waived, and any maintenance, repair, guaranty and warranty required under the Contract, then this obligation to be null and void; otherwise they remain in full force and effect.

PAYMENT BOND

A suit or action commenced hereunder shall comply with applicable Provisions of the Public General Laws of Maryland. No suit or action shall be commenced hereunder against the OBLIGEE, its successors or assigns, nor shall OBLIGEE be liable for any costs or expenses of such suit.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several Seals on the date indicated above, the Name and corporation seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

ATTEST: as to principal

SIGNATURE	SIGNATURE
PRINT NAME	PRINT NAME AND TITLE (SEAL)

ATTEST: as to surety

SIGNATURE	SIGNATURE
PRINT NAME	PRINT NAME AND TITLE (SEAL)

AGENT (COMPANY):

AUTHORIZED BY:

NAME AND TITLE

PAYMENT BOND

APPROVED:

Mayor of Baltimore City

Comptroller

APPROVED AS TO FORM AND
LEGAL SUFFICIENCY:

Chief Solicitor

APPROVED:

Director of General Services

Chief, Capital Projects Division
Department of General Services

APPROVED BY BOARD OF ESTIMATES:

Clerk Date

F. CONSTRUCTION DETAILS AND MATERIALS

Project Manual for the Construction of:

Harford Senior Center
Renovations and Alterations

4920 Harford Rd
Baltimore, MD 21214

DGS Project Number: PRJ000889
RRMM Project Number: 20558
Issue Date: 100% CD Submission
March 12, 2026

Design Team:

Architect
RRMM Architects
3700 Koppers Street, Suite 300
Baltimore, Maryland 21227
Phone No. 410.234.8444

Structural Engineer
Carroll Engineering, Inc.
215 Schilling Cir #102
Hunt Valley, Maryland 21031
Phone No. 410.785.7423

Mechanical / Electrical Engineer
Johnson Consulting Engineers, Inc.
130 West 25th Street, Suite 200
Baltimore, Maryland 21218
Phone No. 410.235.0057

Civil Engineers
Daniel Consultants, Inc.
8950 Route 108 East, Suite 229
Columbia, Maryland 21045
Phone No. 410.995.0090

Industrial Hygienist
EA Engineering, Science and Technology
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031
Phone No. 410.204.5470

Harford Senior Center
Renovations & Alterations
Baltimore, Maryland

DGS Project Number: PRJ000889
RRMM Project Number: 20558
Issue Date: 100% CD Submission
March 12, 2026

Team Member	Contact
Owner	
Baltimore City DGS 200 N. Holliday Street, Suite 204 Baltimore, Maryland 21202	Kevin Allen Phone: 410.396.3704
Architects	
RRMM Architects 3700 Koppers Street, Suite 300 Baltimore, Maryland 21227	Connie Kumor, AIA Phone: 410.234.8444
Structural Engineers	
Carroll Engineering, Inc 215 Schilling Circle, Suite 102 Hunt Valley, Maryland 21031	Kevin Merriman, PE Phone: 410.785.7423
Mechanical and Electrical Engineers	
Johnson Consulting Engineers, Inc. 14205 Park Center Drive, Suite 203 Baltimore, Maryland 21218	Walter Johnson, PE Phone: 410.235.0057
Civil Engineers	
Daniel Consultants, Inc. 8950 Route 108 East, Suite 229 Columbia, Maryland 21045	Richard Sobbott, PE Phone: 410.995.0090
Industrial Hygienist	
EA Engineering, Science and Technology 225 Schilling Circle, Suite 400 Hunt Valley, Maryland 21031	Sherri Waldron Phone: 410.204.5470

Harford Senior Center Renovations and Alterations
4920 Harford Rd, Baltimore, MD 21214
DGS Project Number: PRJ000889
RRMM Architects Project No. 20558

PROCUREMENT & CONTRACTING REQUIREMENTS

00 01 15	List of Drawings	1

DIVISION 1 – GENERAL REQUIREMENTS

01 11 00	Summary of the Work	2
01 22 00	Unit Prices	2
01 23 00	Alternates	1
01 29 73	Schedule of Values	2
01 31 00	Project Management and Coordination	6
01 32 16	Construction Progress Schedules	2
01 32 23	Survey and Layout Data	2
01 32 33	Photographic Documentation	1
01 33 00	Submittals Procedures	3
01 35 00	Special Procedures	4
01 42 19	References Standards	6
01 45 00	Quality Control	3
01 45 29	Testing Laboratory Services	3
01 50 00	Temporary Facilities and Controls	4
01 57 31	Indoor Air Quality Management	7
01 58 13	Temporary Project Signage	1
01 62 00	Product Options	2
01 62 00.01	Substitution Request	1
01 66 00	Product Storage & Handling Requirements	3
01 73 00	Execution	10
01 73 29	Cutting & Patching	3
01 74 00	Cleaning and Waste Management	3
01 74 19	Construction Waste Management & Disposal	5
01 75 00	Starting and Adjusting	2
01 77 00	Closeout Procedures	5
01 78 23	Operation & Maintenance Data	6
01 78 36	Warranties	2
01 78 39	Project Record Documents	4
01 78 43	Extra Stock Material and Spare Parts	1
01 79 00	Demonstration and Training	5

DIVISION 2 – EXISTING CONDITIONS

02 41 19	Selective Demolition	2
02 82 00	Asbestos Abatement	11
02 83 00	Impact to Lead	5
02 84 00	Polychlorinated Biphenyls	4
02 87 00	Ozone Depleting Substances	4
02 88 00	Universal Waste Removal	4
02 89 00	Abatement Monitoring	9

DIVISION 3 – CONCRETE

03 30 00	Cast-In-Place Concrete	16
03 54 17	Cementitious Floor Underlayment	3

DIVISION 4 – MASONRY

04 20 00	Unit Masonry	7

DIVISION 5 – METALS

05 12 00	Structural Steel Framing	8
05 40 00	Cold Formed Metal Framing	8
05 50 00	Metal Fabrications	8
05 51 33	Metal Ladders	3
05 52 00	Metal Railings	3

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITIES

06 10 00	Rough Carpentry	3
06 20 00	Finish Carpentry	3
06 61 19	Quartz Surfacing Fabrication	3

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 21 00	Thermal Insulation	3
07 53 23	FSR – TPO Roofing	11
07 60 00	Flashing and Sheet Metal	3
07 71 23	Gutter and Downspout	3
07 72 00	Roof Accessories	2
07 72 33	Roof Hatch	2
07 84 00	Firestopping	6
07 92 00	Joint Sealers	5

DIVISION 8 – OPENINGS

08 11 13	Hollow Metal Doors and Frames	3
08 14 00	Wood Doors	6
08 14 00	Fiberglass Doors and Panels	4
08 31 00	Access Doors and Panels	3
08 33 32	Rolling Counter Doors	4
08 41 13	Aluminum Framed Entrance & Storefronts	5
08 44 14	Aluminum Sun Shades	3
08 70 00	Hardware	8
08 81 00	Glass and Glazing	6

DIVISION 9 – FINISHES

09 29 00	Gypsum Board	7
09 30 00	Tiling	4
09 51 00	Acoustical Ceilings	4
09 65 00	Resilient Flooring	6
09 65 02	Static Dissipative Resilient Flooring	5

09 65 05	Resilient Wall Base	2
09 65 12	Rubber Flooring	5
09 65 16.23	Resilient Vinyl Sheet Flooring	6
09 67 23	Resinous Flooring	7
09 68 10	Carpet Tile	4
09 91 00	Painting	6

DIVISION 10 – SPECIALTIES

10 14 00	Signage	4
10 21 15	Composite Toilet Compartments	5
10 26 13	Corner Guards	2
10 28 13	Toilet Accessories	3
10 44 16	Fire Extinguishers and Cabinets	2
10 50 20	Canopies	2

DIVISION 11 – EQUIPMENT

11 65 00	Athletic and Recreational Equipment	2

DIVISION 12 – FURNISHING

12 32 11	Manufactured Casework All Plywood	3

DIVISION 13 – SPECIAL CONSTRUCTION (NOT USED)

DIVISION 14 – CONVEYING EQUIPMENT (NOT USED)

DIVISION 21 – FIRE SUPPRESSION (NOT USED)

DIVISION 22 – PLUMBING

22 05 00	Common Work Results for Plumbing	7
22 05 17	Sleeves and Sleeve Seals for Plumbing Piping	4
22 05 18	Escutcheons for Plumbing Piping	2
22 05 23	General Duty Valves for Plumbing Piping	15
22 05 29	Hangers and Supports for Plumbing Piping and Equipment	9
22 05 53	Identification for Plumbing Piping and Equipment	6
22 07 19	Plumbing Piping Insulation	19
22 11 13	Facility Water Distribution Piping	22
22 11 16	Domestic Water Piping	13
22 11 19	Domestic Water Piping Specialties	15
22 13 16	Sanitary Waste and Vent Piping	18
22 13 19	Sanitary Waste Piping Specialties	10
22 14 23	Storm Drainage Piping Specialties	6
22 40 00	Plumbing Fixtures	5
22 47 13	Drinking Fountains	3

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 05 13	Common Motor Requirements for HVAC Equipment	3
23 05 29	Hangers and Supports for HVAC Piping and Equipment	8
23 05 48	Vibration and Seismic Controls for HVAC Piping	8

23 05 53	Identification for HVAC Piping and Equipment	4
23 05 93	Testing, Adjusting, and Balancing for HVAC	8
23 07 13	Duct Insulation	17
23 11 23	Facility Natural Gas Piping	15
23 31 13	Metal Ducts	15
23 31 19	HVAC Casings	8
23 33 00	Air Duct Accessories	13
23 34 16	Centrifugal HVAC Fans	8
23 37 13	Diffusers, Registers, and Grilles	5
23 74 13	Packaged Outdoor Central Air Handling Units	13
23 81 36	Split System Air Conditioners	8

DIVISION 26 – ELECTRICAL

26 05 00	Common Work Results for Electrical	3
26 05 19	Low-Voltage Electrical Power Conductors and Cables	5
26 05 23	Control Voltage Electrical Power Cables	13
26 05 26	Grounding and Bonding for Electrical Systems	7
26 05 29	Hangers and Supports for Electrical Systems	6
26 05 33	Raceways and Boxes for Electrical Systems	11
26 05 39	Underfloor Raceways for Electrical Systems	1
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling	5
26 05 53	Identification for Electrical Systems	11
26 05 73	Overcurrent Protective Device Coordination Study	6
26 09 23	Lighting Control Devices	8
26 24 16	Panelboards	14
26 27 26	Wiring Devices	7
26 28 13	Fuses	4
26 28 16	Enclosed Switches and Circuit Breakers	10
26 43 13	Surge Protection Device for Low-Voltage Electrical Power Circuits	7
26 51 00	Interior Lighting	8
26 51 13	Interior Lighting LED Dimming Drivers	5
26 56 00	Exterior Lighting	6

DIVISION 28 – ELECTRONIC SAFTEY AND SECURITY

28 31 11	Digital, Addressable Fire-Alarm System	14

DIVISION 31 – EARTHWORK (NOT USED)

DIVISION 32 – EXTERIOR IMPROVEMENTS (NOT USED)

DIVISION 33 – UTILITIES (NOT USED)

DOCUMENT 00 01 15

LIST OF DRAWINGS

A000	Cover Sheet
G101	General Notes
CA101	Code Analysis

CIVIL DRAWINGS

C01	Site Plan

ARCHITECTURAL DRAWINGS

D101	Demolition Floor Plan
D102	Demolition Roof Plan
A101	Floor Plan
A102	Reflected Ceiling Plan
A103	Roof Plan & Details
A104	Bid Alternates #1 & #2
A105	Bid Alternates #1 & #2
A201	Elevations
A202	Elevations
A301	Building Sections
A401	Interior Elevations & Details
A402	Enlarged Ramp Plan & Details
A501	Roof Details
A502	Details
A601	Door & Finish Schedules
A602	Head, Jamb, Sill Details

STRUCTURAL DRAWINGS

S001	Notes, Schedules, & Details
S101	Foundation & Roof Framing Plans
S201	Typical Details

MECHANICAL DRAWINGS

M000	Mechanical Legend & Abbreviations
MD100	Mechanical Demolition Plan
MD101	Mechanical Demolition Roof Plan
M100	Mechanical New Work Plan
M101	Mechanical New Work Roof Plan
M200	Mechanical Schedules
M300	Mechanical Details
M400	Mechanical Details II

PLUMBING DRAWINGS

P000	Plumbing General Notes & Legend
P001	Plumbing Schedules
P002	Plumbing Details
PD100	Plumbing Floor Plan – Demolition
PD101	Plumbing Roof Plan – Demolition
PD200	Plumbing Floor Plan – Demolition Part Plan
P100	Plumbing Floor Plan – New Work
P101	Plumbing Roof Plan – New Work
P200	Plumbing Floor Plan – New Work Part Plans
P300	Plumbing Riser Diagrams

ELECTRICAL DRAWINGS

E-000	Electrical Cover Sheet
ED-101	Lighting RCP Plan – Demolition
ED-102	Power Floor Plan – Demolition
ED-103	Roof Plan – Demolition
E-101	Electrical Lighting Plan – New Work
E-102	Electrical Power Plan – New Work
E-103	Electrical Roof Plan – New Work
E-200	Electrical Panels
E-201	Electrical Riser Diagram
E-300	Electrical Details

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Summary by References:
Work of Contract can be summarized by reference to the Contract, General Conditions, Supplementary Conditions, specifications sections as listed in the "Table of Contents" bound herewith, drawings as listed in "Drawings Index" bound herewith, addenda and modifications to the contract documents issued subsequent to the initial printing of this project manual, and including but not necessarily limited to printed matter referenced by any of these. It is recognized that work of Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions, and other forces outside the contract documents.

B. Generally, without force or effect on the work of the contract, the work of the contract can be described to include, but is not limited to, the following:

1. Selective demolition of building components including but not limited to interior partitions, ceilings, doors, floor/ceiling/wall finishes, commercial food equipment and exhaust, and mechanical/electrical/plumbing systems.
2. Extensive renovation and alteration of the existing building throughout the entire interior and portions of the exterior envelope.
3. Site development including but not limited to, grading, water and sanitary sewer utilities, electrical power service
4. New mechanical heating and cooling systems.
5. New exhaust air ductwork and fans.
6. General purpose electrical power connections, and new equipment connections.
7. New lighting fixtures, controls, and wiring.
8. New plumbing system piping and fixtures.
9. Fire alarm system.
10. New metal stud and gypsum wallboard partitions.
11. New floor, wall, and ceiling finishes.
12. New exterior handicap ramp and stair.
13. New roofing systems and drainage devices.
14. New roof framing to accommodate new rooftop equipment.
15. Alternates

C. Related Work:
Contract Documents indicate the work of the Contract, and related provisions of the project which may include but are not necessarily limited to the following:
1. Existing site conditions and restrictions.
2. Other work prior to work of Contract.
3. Alterations and coordination with existing work.
4. Other work to be performed concurrently by Owner.
5. Other work to be performed concurrently by separate contractors.
6. Other work subsequent to work of Contract.
7. Alternates which are work of Contract, and alternates which are not work of Contract.

1.2 REFERENCED STANDARDS

Where reference is made to publications, tests, standard specifications, manufacturer's directions, data sheets, or other literature, latest edition published before date of specifications applies.

1.3 ABBREVIATED SPECIFICATIONS

Portions of specifications may be abbreviated or streamlined and include incomplete sentences. Omission of words or phrases such as "Contractor shall," "In conformity therewith," "shall be," "as noted on Drawings," "a," "an," "the," and "all" are intentional. Omitted words and phrases will be supplied by inference in the same manner as they are for notes on the Drawings.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 INITIAL SUBMISSIONS

A. Plan of Operations: Within 5 days following award of Contract, prepare rough draft of "Plan of Operations" and review with Owner and Architect for acceptance. After discussing rough draft with Owner and Architect, make any necessary changes, prepare final draft, and resubmit. Any later deviations from approved plan shall be discussed with and receive acceptance from Owner and Architect well in advance of proposed date for placing new plan in affect. Include following items in Plan of Operations:
   1. Sequence of Operations;
   2. Graphic schedule showing anticipated completion dates for various phases of work;
   3. General information to assist Owner in planning arrangements for services and work not included in this Contract and in preparing for occupancy;
   4. Other pertinent details that occur to Contractor, Owner, or Architect.

3.2 ARCHITECT'S ADMINISTRATIVE FORMS

A. Following forms published by American Institute of Architects shall be used in administration of contract.

TITLE	AIA DOCUMENT NO.
Change Order	G 701
Application and Certificate for Payment	G 702
Certificate of Substantial Completion	G 704
Contractor's Affidavit of Payment of Debts & Claims	G 706
Contractor's Affidavit of Release of Liens	G 706A
Consent of Surety to Final Payment	G 707
Consent of Surety to Reduction in or Partial Release of Retainage	G 707A

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. A unit price is an amount proposed by the Contractor as part of the bid process to establish a price per unit of measurement for materials or services added to or deducted from the Contract Sum by incorporating the unit price stipulated in the Contractor's bid form, and multiplying the unit price by the amount of work completed (work that is subject to unit pricing) to arrive at the amount of compensation to be paid the Contractor for the unit price work.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, labor, equipment, installation, insurance, applicable taxes, overhead, and profit.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor.

C. A list of unit prices is included in Part 3. Specification sections referenced in the schedule contain requirements for materials described under each unit price.

D. The Owner reserves the right to withdraw the work described in the unit prices from the Work of the Contract and reduce the Contract stipulated fee by the dollar values assigned to the respective unit prices.

E. The Owner reserves the right to increase the Contract lump sum amount using the respective unit prices, if the measurement of the volume of unit price work exceeds the amount included in the Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 LIST OF UNIT PRICES

A. General: Provide a cost for each unit price item on the Bid Form:

Unit Price #1- Wood Blocking:

The unit price shall represent the total cost to furnish and install 2x8 pressure treated, fire retardant rough lumber blocking at locations that are above and beyond the blocking indicated in the contract documents; and at the direction of the Owner or Owner's Representative. Payment will be made for the actual quantity of material installed measured by the linear foot. Estimated quantity of additional blocking to be included: (50) linear feet.

Unit Price #2- Gypsum Deck Repairs:

Provide all labor, material, equipment, and services necessary and incidental to replace portions of damaged gypsum decking with new gypsum panels and reinforcing. Payment will be made for the actual quantity of decking repairs measured by the square foot. Estimated quantity of gypsum decking to be included: (50) square

feet.

Unit Price # 3 – Patch existing concrete slab

Provide all labor, material, equipment, and services necessary and incidental to repair portions of the existing concrete slab with new cast in place concrete and reinforcing. Payment will be made for the actual quantity of slab repair measured by the square foot. Estimated quantity of concrete slab repair to be included: (50) square feet.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes alternate items of work quoted on Bid Form which will be accepted or rejected at the Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work as required.

1.2 ALTERNATES, GENERAL

A. Definitions: Alternates are defined as alternate products, materials, equipment, installations or systems for the work, which may at the Owner's option and under terms established by the Instructions to the Bidders, be selected and recorded in the Contract to either supplement or displace corresponding basic requirements of the Contract Documents.

B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "allowances", "unit prices", "change orders", "substitutions", and other similar provisions.

C. General Provisions: A "Schedule of Alternates" is included at the end of this section. Each alternate is defined by abbreviated language, recognizing that drawings and specification sections document the requirements. Coordination of related work is required to ensure that work affected by each selected alternate is complete and properly interfaced with work of alternates.

D. Notification: Immediately following award of Contract prepare and distribute to each entity to be involved in performance of the work, a notification of status of each alternate. Indicate which alternates have been: 1) Accepted, 2) Rejected, and 3) Deferred for consideration at a later date as indicated. Include full description of negotiated modifications to alternates, if any.

E. Alternate prices submitted with the contractor's bid shall be valid for the full term of the contract and shall become part of the contract scope of work at any time, at the sole discretion of the Owner.

1.3 ALTERNATE SCHEDULE

A. Alternate No. 1: Storefront Replacement and Awning
The Contractor shall provide all labor, material, equipment and services necessary and incidental to the demolition of the existing exterior storefront system and existing awning at the east elevation, the construction of the new exterior storefront system and sun shade devices at the east elevation of the building, and the installation of prefabricated canopy structures with integral lighting and drainage at the east and west entrances.

B. Alternate No. 2: New Building Identification Sign
The Contractor shall provide all labor, material, equipment and services necessary and incidental to the construction of the new exterior, cast letter building identification signage as indicated on the drawings and in section 10 14 00 Signage.

END OF SECTION

SECTION 01 29 73

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of Schedule of Values.

1.2 FORMAT

A. Follow Table of Contents of Project Manual for listing component parts. Identify each line item by number and title of major Specifications Section.

B. Identification: Include the following Project identification on the Schedule of Values:
   1. Project name and location.
   2. Name of Architect.
   3. Architect and Owner's project number.
   4. Contractor's name and address.
   5. Date of submittal.

C. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   1. Related Specification section or division.
   2. Description of work.
   3. Name of subcontractor.
   4. Name of manufacturer or fabricator.
   5. Name of supplier.
   6. Change Orders (numbers) that affect value.
   7. Dollar value
   8. Percentage of Contract Sum to nearest one-hundredth percent, adjusted total 100 percent.

1.3 CONTENT

A. List installed value of each major item of work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments as extracted/determined from the cost loaded Progress Schedule. Round off values to nearest dollar. Indicate material cost separate from related labor cost.

B. For each major subcontract, list products and operations of that subcontract as separate line items.

C. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.

D. Allowances Unit Prices and Alternates: Provide a separate line item in Schedule of Value for each allowance, Unit Price and Alternate. Show line-item value of unit prices, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract documents to determine quantities.

E. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   1. Application for Payment forms with Continuation Sheets.
   2. Submittals Schedule.
   3. Contractor's Construction Schedule.
   4. List of subcontractors.
   5. Schedule of allowances.
   6. Schedule of alternates.
   7. List of products.
   8. List of principal suppliers and fabricators.

F. Component listings shall each include a directly proportional amount of Contractor's overhead and profit. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the Schedule of Values.

H. For items on which payments will be requested for stored products, list sub-values for cost of stored products.

I. The sum of values listed shall equal total Contract Sum.

1.4 SUBMITTAL

A. Submit 2 copies of the Draft Schedule of Values 15 calendar days prior to first Application for Payment to the Owner and two copies to the Architect. Form and content shall be acceptable to Owner.

B. Transmit under transmittal letter. Identify Project by title and number; identify Contract by number.

C. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when change Orders or Construction change Directives result in a change in the Contract Sum.

1.5 SUBSTANTIATING DATA

A. When the Owner and/or the Architect/Engineer require substantiating information, submit data justifying line item amounts in question.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

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

B. Related Requirements:

1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 INFORMATIONAL SUBMITTALS

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

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

1.3 GENERAL COORDINATION PROCEDURES

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

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

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

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

1.4 REQUEST FOR INFORMATION (RFI)

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

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

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

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

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

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

a. Requests for approval of submittals.

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

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

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

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Use software log that is part of web-based Project management software.

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

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

1.5 DIGITAL PROJECT MANAGEMENT PROCEDURES

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

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

B. Web-Based Project Management Software Package: Use Owner's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
c. Document workflow planning, allowing customization of workflow between project entities.
d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Owner to provide licenses for accessing their preferred web-based project management software.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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 submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.6 PROJECT MEETINGS

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

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

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

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.

c. Critical work sequencing and long lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Use of web-based Project software.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for testing and inspecting.
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.
m. Sustainable design requirements.
n. Preparation of Record Documents.
o. Use of the premises.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

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

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

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

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

1) Review schedule for next period.

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of construction Progress Schedules and periodical updating.

1.2 FORMAT

A. Prepare Windows operating system compatible, Computer Driven Network Analysis System using the critical path method as outline in the Associated General Contractors of America (AGC) Publication "The Use of CPM in Construction - A Manual for General Contractors". Include both site and building unit sequences.

B. Sequence of Listing: Logic diagrams shall be generated and plotted by computer. Plot size shall be such that all activity descriptions and durations are easily readable (24 inches by 36 inches min.). Plots shall be time scaled and show interdependency of all activities. Plot critical path in red color.

C. Provide printed reports as described below.

1.3 CONTENT

A. Logic diagrams shall include the following for each activity as a minimum. The Owner or Architect may require additional information for each activity.
   1. Actual costs vs. planned costs.
   2. Activity node number(s).
   3. Activity description.
   4. Activity duration.
   5. Activity float.
   6. Critical path.
   7. Restraints or "dummies".
   8. Milestone dates.

B. Logic diagram shall also include procurement activities to include submittal, approval, and fabrication/delivery times. This procurement schedule shall be keyed to the submittal log.

C. Printed reports shall include the following information for each activity as a minimum. The Owner or Architect may require additional information for each activity.
   1. Activity node number(s).
   2. Activity description.
   3. Activity duration.
   4. Activity cost.
   5. Activity percent complete.
   6. Activity crew size.
   7. Activity early start and completion dates.
   8. Activity late start and completion dates.
   9. Float.
   10. Activity Specification Section.

D. Printed reports shall be sorted as follows for each building:
   1. I-J (ascending activity order).
   2. Critical Path (or float).
   3. Early start by critical path.
   4. Specification Section with total earned and total percent complete.
   5. Cash flow based on early completion by month.

6. Overall percent complete.

E. Specification sort shall be the basis of determining monthly requisitions.

1.4 MONTHLY UPDATES AND REVISIONS

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

D. Revise and regenerate logic diagrams at the direction of the Owner/SPM if significant logic changes are proposed.

E. Generate cash flow/percent complete "S" curves for each building with each update, comparing present status of project with original, as-planned schedule.

F. Provide charts recording total project float for each building, each month.

1.5 SUBMITTALS

A. Submit initial Schedules referenced in Article "FORMAT" of this Section at Preconstruction Conference but, no later than 15 calendar days after Notice-to-Proceed Date to the Architect. After review, resubmit required revised data within 10 calendar days.

B. Submit revised Progress Schedules with each Application for Payment in both paper and computer readable formats.

C. Submit the number of opaque reproductions that Contractor requires, plus 8 copies that will be retained by Owner with each Application for Payment.

1.6 DISTRIBUTION

A. Distribute copies of reviewed Schedules to job site file, subcontractors, suppliers, and other concerned entities.

B. Instruct recipients to promptly report, in writing, problems anticipated by projects shown in Schedules.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 32 23

SURVEYS AND LAYOUT DATA

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Field Engineering and Surveying Services.

1.2 QUALITY CONTROL
A. Professional Surveyor: The Contractor shall provide a Registered Professional Land Surveyor or Property Line Surveyor of the discipline required for specific service on Project, licensed in the State of Maryland.

B. Recover and use previously set control monuments in compliance with the Contract Drawings.

1.3 SUBMITTALS
A. Survey Data: Submit name, address, and telephone number of Surveyor.

B. On request, submit documentation verifying accuracy of survey work.

C. Submit certificate signed by Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

1.4 PROJECT RECORD DOCUMENTS
A. Maintain complete, accurate log of control and survey work as it progresses.

B. Contractor shall conduct a monthly review of Record Documents. Contractor shall maintain these documents current and if not, payment may be withheld from the Contractor because documents are unacceptable during review by Architect.

C. On completion of all site improvements, prepare a certified reproducible 24 inches by 36 inches, 4 mil mylar survey sheet showing topographic contours, dimensions, locations, angles, and elevations of constructed site work, utilities, and building locations with other pertinent data.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.1 INSPECTION
A. Verify locations of survey control points prior to starting work. Promptly notifying Architect of any discrepancies discovered.

3.2 SURVEY REFERENCE POINTS
A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to Owner and Architect.

B. Promptly report to Owner and Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points, at no cost to the Owner, based on original survey control.

3.3 SURVEY REQUIREMENTS
A. Establish a minimum of 2 permanent bench marks on the site, referenced to established

control points. Record locations with horizontal and vertical data on Project Record Documents.

B. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements, including pavements; stakes for grading, fill and topsoil placement; and utility locations, slopes, and invert elevations.
   2. Perimeter of building structures.

C. Periodically verify layouts by same means to maintain horizontal and vertical control.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction Photography.

B. Submittals.

1.2 PHOTOGRAPHY SERVICES

A. Provide to the Owner copies of all digital photographs, taken during the course of the work of the contract.

1.3 PHOTOGRAPH FORMAT

A. Full color; minimum 16.0 mega pixel digital resolution photograph file; converted to JPG format for viewing.

B. Identification: Provide an individual file number for each digital photograph. Provide a separate Microsoft Word file that lists the name of Project, phase, orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

PART 2 - PRODUCTS

2.1 PHOTOGRAPH FILES

A. Deliver digital file copies of photographs to Owner, at each Application for Payment submission. Catalog and index photograph files in chronological sequence; provide typed table of contents.

B. Provide photographer's release of copyrights at job completion.

PART 3 - EXECUTION

3.1 TECHNIQUE

A. Provide factual presentation of construction progress.

B. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

3.2 VIEWS

A. Provide complete set of not less than (30) different views of the project, at the start of construction, one day each week during construction, and at Substantial Completion.

B. Consult with Owner Representative or Architect as required for instructions on views required.

END OF SECTION

SECTION 01 33 00

SUBMITTALS PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Submittal procedures
2. Proposed products list
3. Shop drawings
4. Product data
5. Samples
6. Manufacturers' instructions
7. Manufacturers' certificates

1.2 SUBMITTAL PROCEDURES

A. Consecutively number all submittals.
1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
2. On re-submittals, cite the original submittal number for reference.

B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.

C. Identify Project, Contractor, subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

D. The Contractor shall include a statement on all submittals indicating that "**Contractor has reviewed the submittal and coordinated this product with the work of the contract, and further certifies that this product complies in every aspect with the requirements of the Contract Documents**". Any deviations from the requirements of the Contract Documents or variation from the specified product shall be described in detail in writing in a cover letter to the submittal.

E. On at least the first page of each component of the submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

F. Identify variations from Contract Documents and product of system limitations which may be detrimental to successful performance of the completed Work. Substitutions shall be clearly identified and shall comply with procedures for requesting a substitution.

G. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.

H. In scheduling, allow at least ten (15) working days for review following receipt of this submittal.

I. Architect's review does not relieve the Contractor and subcontractor from responsibility for errors which may exist in the submitted data.

J. Revisions:
1. Make revisions required.
2. If the Contractor considers any required revision to be a change, the Contractor shall make notification as provided for in the General Conditions.
3. Make only those revisions directed or approved.

K. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
   1. Partial submittals may be rejected as not complying with the provisions of the Contract.
   2. The Contractor may be held liable for delays so occasioned.

L. Maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect for his review upon request.

1.3 PROPOSED PRODUCTS LIST

A. Submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.4 SHOP DRAWINGS

A. Shop drawings shall not be reprints of the Contract Drawings.

B. All deviations from the contract documents shall be highlighted on the shop drawings and further enumerated in detail in writing on a separate cover letter to the submittal.

C. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

D. Types of prints required: Submit Shop Drawings in digital form, electronically transmitted Adobe Acrobat PDF files.

E. The Architects review comments will be returned as an electronic transmission.

1.5 PRODUCT DATA

A. Submit digital, electronically transmitted, Adobe Acrobat PDF files

B. Mark each submittal to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.

C. After review, distribute as required.

D. **Safety Data Sheets, and the information provided therein, are not part of the Architect's review. The Contractor shall be responsible for the use and implementation of products that comply with safety standards.**

1.6 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinated sample submittals for interfacing work.

B. Submit samples of finishes in color ranges specified, textures, and patterns for Architect selection.

C. Include identification on each sample, with full Project information. This identification shall be securely affixed to the sample.

D. One of each of the samples submitted as specified in individual specification Sections will be retained by Architect.

E. Reviewed samples which may be used in the Work are indicated in individual specification

Sections.

1.7 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.8 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturers' certificate to Architect for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

PART 2 - PRODUCTS

2.1 DEFINITIONS

A. Approved Equal

The term “Approved Equal” , as it is used in the Contract Documents, shall be interpreted as an opportunity for the Contractor to substitute a product that is equal to the specified product in all regards, subject to approval by the Architect of the substitution. The burden for researching the market place and finding an “Approved Equal” product shall be the sole responsibility of the Contractor. The use of the term “Approved Equal” shall in no way be interpreted to mean that an equal product is currently manufactured or available. The use of the term “Approved Equal” is intended to communicate to the contractor that the Architect has not conducted an exhaustive search to find equal products, but the Contractor has the opportunity to do so.

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 35 00

SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The types of minimum requirements for procedures and performance or control work of a general nature include but are not necessarily limited to the following categories:
   1. General installation provisions
   2. Coordination and meetings
   3. Surveys and records
   4. Limitations for use of site
   5. Workmanship
   6. Cleaning and protection
   7. Conservation and salvage

1.2 EXISTING SITE CONDITIONS

The Owner makes no guarantee as to the accuracy of the data shown on the drawings as existing conditions. The Contractor shall verify all pre-existing conditions on the site prior to the start of work.

1.3 PERMITS AND INSPECTIONS BY AGENCIES HAVING JURISDICTION

A. Permits:
   The Owner will pay for the initial Building Permit application. The Contractor shall obtain and pay for the Building Permit, except for the filing fee. The Contractor shall be responsible for obtaining and paying for any and all extensions of the Building Permit should extensions become necessary. The Contractor shall be responsible for safeguarding the permit and shall pay all costs for replacement of the permit documents should it become lost, stolen, damaged or otherwise removed from the site. The Contractor shall be responsible for the expense of all trade and any other permits required by Agencies having jurisdiction.

B. Inspection by Agencies Having Jurisdiction:
   The Contractor shall be responsible for the timely scheduling of inspections of the Work by Agencies having jurisdiction. The Contractor shall be responsible for notification of the appropriate Agencies, coordination with the inspection procedures of the Agencies, and providing adequate access for inspectors

1.4 SITE UTILITIES

A. Coordinate construction operations of all trades involved in the project to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

B. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

C. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.

D. Make adequate provisions to accommodate items scheduled for later installation.

1.5 SMOKING

Smoking is strictly prohibited at the job site at all times.

1.6 CONSTRUCTION MANAGEMENT SOFTWARE
The contractor is responsible for accessing and utilizing the Owner's preferred web-based construction management software program for collaborative document management throughout the construction process.

1.7 OWNER'S SYSTEM VENDORS
The contractor is responsible for coordination with the owner's system vendors. Contractor to coordinate construction operations that depend on each other for proper installation, connection, and operation, and appropriately allocate time in the construction schedule to allow for coordination with the owner's system vendors.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

3.1 LAYING OUT WORK

A. The Contractor shall lay out their own work and be responsible for all lines, elevations, and measurements of work they execute under Contract. They must exercise proper precaution to verify figures shown on Drawings before laying out work.

B. The Contractor shall take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work.

3.2 MANUFACTURER'S DIRECTIONS
All manufactured articles, materials, equipment, fixtures, and accessories shall be handled, stored, applied, installed, connected, erected, used, cleaned, and conditioned as manufacturers direct, unless Architect otherwise indicates, specifies, or directs, in writing.

3.3 GENERAL INSTALLATION PROVISIONS

A. Manufacturer's Instructions

1. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to the extent these are more explicit or more stringent than requirements indicated in the contract documents.
2. All manufactured articles, materials, equipment, fixtures, and accessories shall be handled, stored, applied, installed, connected, erected, used, cleaned, and conditioned as manufacturers direct, unless Architect otherwise indicates, specifies, or directs, in writing.
3. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.
4. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansion and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual effect choices to the Architect for final decision.
5. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
6. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
7. Coordinate enclosure of work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

B. Mounting Heights

Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for applications indicated. Refer questionable mounting height choices to the Architect for final decision.

3.4 COORDINATION OF ALL WORK OF THE CONTRACT

A. General

Prepare, communicate and distribute to each entity performing work at the project instructions on required coordination activities, including required notices, reports and attendance at meetings. Take all necessary action to coordinate separate contractors where interfacing of work is required. The Contractor is responsible for reviewing all of the separate systems, equipment, finishes and appurtenances of the project in advance of their fabrication, delivery, and construction. The Contractor shall layout all work of the contract in advance of fabrication, delivery and construction, and shall resolve all interference between the separate systems, equipment, finishes and appurtenance components.

B. Coordination Drawings

Where work by separate entities requires off-site fabrication of products and materials which must be accurately interfaced and closely intermeshed to produce required results, prepare coordination drawings to indicate how work shown by separate shop drawings will be interfaced, intermeshed, and sequenced for installation. Comply with submittal requirements of “Submittals” section.

C. Responsibility for Quality Assurance:

The Contractor is responsible for the timing and/or scheduling of the ordering, shipping, fabrication, delivery and installation of all materials at all times throughout the contract. Payment by the Owner for stored materials shall not be an indication of acceptance of those materials with regards to the quality, size, fit or dimensional accuracy. The Owner does not waive the Owner’s right to reject un-satisfactory, unacceptable materials, by way of payment for stored materials.

3.5 LIMITATIONS FOR USE OF SITE

A. General

In addition to site utilization limitations and requirements shown on the drawings, and indicated by other contract documents, administer allocation of available space equitably among entities needing access and space, so as to produce the best overall efficiency in performance of total work of project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

3.6 TRADESPERSONS AND WORKMANSHIP STANDARDS

A. General

Investigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

3.7 CLEANING AND PROTECTION

A. General

During handling and installation of work at the project site, clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Limiting Exposures of Work
To the extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work is subject to dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemical, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

3.8 CONSERVATION AND SALVAGE
It is a general procedural requirement for supervision and administration of the work that construction operations be carried out with maximum practical consideration for conservation of energy, water and materials; and with maximum practical consideration for salvaging materials and equipment involved in performance of the work but not incorporated therein. Refer to other sections for required disposition of salvage materials and equipment which are Owner's property.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Applicability of Reference Standards.

B. Provision of Reference Standards at Site.

C. Acronyms used in Contract Documents for Reference Standards. Source of Reference Standards.

1.2 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The date of the standard is that in effect as of the Bid Date, or date of Owner-Contractor Agreement when there are no bids, except when a specific date is specified.

C. When required by individual Specification Section, obtain copy of standard. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

1.3 SCHEDULE OF REFERENCES

AA Aluminum Association
1525 Wilson Blvd.
Arlington, VA 22209
703-358-2960

AABC Associated Air Balance Council
1518 K Street NW, Suite 503
Washington, DC 20005
202-737-0202

AASHTO American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001
202-624-5800

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219
248-848-3700

ADC Air Diffusion Council
230 North Michigan Avenue
Chicago, IL 60601
847-706-6750

ADA Americans with Disabilities Act
US Dept of Justice
950 Pennsylvania Ave. NW

Washington, DC 20530
800-514-0301

AGC Associated General Contractors of America
2300 Wilson Blvd., Suite 400
Arlington, VA 22201
703-548-3118

AI Asphalt Institute
2696 Research Park Drive
Lexington, KY 40511
859-288-4960

AISC American Institute of Steel Construction
One East Wacker Dr., Suite 700
Chicago, IL 60601
312-670-2400

AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004
847-394-0150

ANSI American National Standards Institute
25 W. 43rd Street, 4th Floor
New York, NY 10036
212-642-4900

APA American Plywood Association
Box 11700
Tacoma, WA 98411
253-620-7400

AHRI Air-Conditioning Heating and Refrigeration Institute
2111 Wilson Blvd., Suite 500
Arlington, VA 22201
703-524-8800

ASHRAE American Society of Heating, Refrigerating and
Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329
404-636-8400

ASME American Society of Mechanical Engineers
3 Park Ave
New York, NY 10016
800-843-2763

ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19103
610-832-9500

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

800-926-7337

AWPA American Wood-Preservers' Association
P.O. Box 361784
Birmingham, AL 35236
205-733-4077

AWS American Welding Society
550 LeJeune Road
Miami, FL 33135
800-443-9353

COMAR Codes for the State of Maryland
Division of State Documents
16 Francis Street
Annapolis, MD 21401
410-974-2486

CDA Copper Development Association
260 Madison Ave.
New York, NY 10016
212-251-7200

CLFMI Chain Link Fence Manufacturers Institute
10015 Old Columbia Rd, Suite B215
Columbia, MD 21046
301-596-2583

CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60195
847-517-1209

EJCDC Engineers' Joint Contract Documents Committee
American Consulting Engineers Council
1050 15th Street, N.W.
Washington, DC 20005
202-347-7474

FGMA Flat Glass Marketing Association
3310 Harrison
White Lakes Professional Building
Topeka, KS 6661

FM Factory Mutual
P.O. Box 9102
Norwood, MA 02062
781-440-8000

FS Federal Specification
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

GA Gypsum Association
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782

301-277-8686

IEEE Institute of Electrical and Electronics Engineers
3 Park Avenue, 17th Floor
New York, NY 10016
212-419-7900

IBC International Building Code
Latest Editions, as Published by the International Code Council (ICC)
500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001
888-422-7233

ICC International Code Council
500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001
888-422-7233

IMIAC International Masonry Industry All-Weather Council
International Masonry Institute
815 15th Street, N.W.
Washington, DC 20005

MDOT Maryland Department of Transportation
Maryland State Highway Administration
P.O. Box 548
Hanover, MD 21076
410-865-1000

MIL Military Specification
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

ML/SFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

NAAMM National Association of Architectural Metal Manufacturers
800 Roosevelt Rd., Sldg C, Suite 312
Glen Ellyn, IL 60137
630-942-6591

NEBB National Environmental Balancing Bureau
8575 Grovemont Circle
Gaithersburg, MD 20877
301-977-3698

NEMA National Electrical Manufacturers' Association
1300 N. 17th Street, Suite 1752
Rosslyn, VA 22209
703-841-3200

NFPA National Forest Products Association
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

NSWMA National Solid Wastes Management Association
4301 Connecticut Avenue, N.W., Suite 300
Washington, DC 20008
202-244-4700

NTMA National Terrazzo and Mosaic Association
PO Box 2605
Fredericksburg, TX 778624
800-323-9736

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077
847-966-6200

PCI Prestressed Concrete Institute
200 W. Adams Street, #2000
Chicago, IL 60606
312-786-0300

PS Product Standard
U.S. Department of Commerce
Washington, DC 20203

SDI Steel Deck Institute
Box 3812
St. Louis, MO 63122
847-458-4647

SDI Steel Door Institute
30200 Detroit Road
Westlake, OH 44145
440-899-0010

SIGMA Sealed Insulating Glass Manufacturers Association
401 N. Michigan Ave., Suite 2400
Chicago, IL 60611
312-644-6610

SJI Steel Joist Institute
1173B London Links Drive
Forest, VA 24551
434-525-7377

SMACNA Sheet Metal and Air Conditioning Contractors' National Association
4201 LaFayette Center Drive
Chantilly, VA 20151
703-803-2980

SSPC Steel Structures Painting Council
40 Twenty-Fourth Street, 6th Floor
Pittsburgh, PA 15222
877-281-7772

TAS Technical Aid Series
Construction Specifications Institute
110 S. Union Street, Suite 100

Alexandria, VA 22314
800-689-2900

TCNA Tile Council of North America, Inc.
100 Clemson Research Blvd.
Anderson, SC 29625
864-646-8453

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062
847-272-8800

WCLIB West Coast Lumber Inspection Bureau
Box 23145
Portland, OR 97223
503-639-0651

WSSC Washington Suburban Sanitary Commission
14501 Sweitzer Lane
Laurel, MD 20707
800-828-6439

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance and control of installation.

B. References.

C. Field samples.

D. Field Constructed Mock ups.

E. Inspection and testing laboratory services specified in Sections of Divisions 2 through 48 of these Specifications.

F. Manufacturers' field services and reports specified in Sections of Divisions 2 through 48 of these Specifications.

1.2 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. All manufactured articles, materials, equipment, fixtures and accessories shall be handled, stored, applied, installed, connected, erected, used, cleaned and conditioned, as directed by the manufacturers, unless otherwise indicated, specified, or directed by the Architect in writing. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect **before** proceeding.

D. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stressed, vibration, physical distortion or disfigurement.

1.3 GENERAL WORKMANSHIP

A. Workmanship shall be neat, thorough, substantial and conform to the following, unless otherwise indicated or specified.

B. Units: Set level, plumb, or true to other lines indicated. Fit neatly and closely together and anchor firmly in place.

C. Surfaces:
1. Level, plumb, true to indicated plane;
2. Smooth, flat;
3. Uniform in color and texture;
4. Clean and neat in appearance.

D. Joints and seams: Conceal where possible, except where otherwise indicated or specified.

E. Joints and seams exposed to view:
1. Neat, straight, tight, flush, smooth, uniform, strong;

2. Plumb, level or otherwise true to line indicated;
3. Located where least conspicuous;
4. Construct to prevent opening;
5. Equally spaced;
6. Obtain Architect's written acceptance of joints and seams exposed to view, except where such exposure is shown or specified.

F. Coursing: Uniform, accurately spaced, modular unless otherwise noted.

G. Corners, straight square, sharp, neat, plumb, level or true to other lines indicated.

H. Anchors, fastenings, connections, accessories:
1. Provide anchors, fastenings, framing, supports, hangers, bracing, brackets, straps, angles, bolts, etc., adequate in size, design and quantity to set and connect work rigidly in place and to safely sustain stresses to which they will normally be subjected.
2. Conceal such work where possible, except where otherwise indicated or specified.
3. Such items exposed to view shall be equally spaced, located where least conspicuous and neat in appearance. Obtain Architect's written acceptance of exposed items except where such exposure is shown or specified.

1.4 REFERENCES

A. Where reference is made to publications, tests, standard specifications, manufacturer's directions, data sheets or other literature unless the date is stated, the latest edition published before date of specifications shall apply.

B. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect.

1.6 MOCK-UP

A. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes.

B. Full scale mock-ups of proposed construction are specified in individual sections. All mockups shall be full size, separately constructed samples that incorporate the relevant components of the feature being considered by the Owner’s representative as an assembly that complies with the contract requirements.

C. **Mock-ups shall be constructed on the project site, or constructed off-site and transported to the project site, by the Contractor. The mock-up shall remain on the site at an accessible location until the Owner’s representative approves the Contractor’s request to remove the mock-up. The Contractor shall protect and maintain the mock-up. Upon approval from the Owner’s representative, the Contractor shall remove the mock-up from the project site.**

1.7 INSPECTION AND TESTING LABORATORY SERVICES

A. Submit name and qualifications of independent testing agencies for approval by the Owner and Architect prior to commencement of the work.

B. The independent firm will perform inspections, test, and other services specified in individual specification Sections and as required by the Architect.

C. Reports will be submitted by the independent firm to the Architect, in triplicate, indicating observations and results of test and indicating compliance or non-compliance with Contract Documents.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
   1. Notify Architect and independent firm 48 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions from the Architect. The cost of re-testing shall be borne by the Contractor.

1.8 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Submit qualifications of observer to Architect 30 days in advance of required observations. Observer subject to approval of Architect and Owner.

B. When specified in individual specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, test, adjust, and balance of equipment as applicable.

C. Contractor shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

D. Submit report in duplicate to Architect for review, within 15 days of observation.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Selection and payment.

B. Laboratory responsibilities.

C. Laboratory reports.

D. Limits on testing laboratory authority.

E. Contractor responsibilities.

F. Schedule of inspections and tests.

1.2 REFERENCES

A. ANSI/ASTM D 3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ANSI/ASTM E 329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.3 SELECTION AND PAYMENT

A. Contractor shall employ and pay for services of an independent testing laboratory to perform Certified Inspection and Testing Firm (CITF) when testing is indicated in the separate specification sections of these Contract Documents.

B. Employment of testing laboratory (CITF) shall in no way relieve Contractor of obligation to perform work in compliance with requirements of Contract Documents.

1.4 CERTIFIED INSPECTION AND TESTING FIRM (CITF) RESPONSIBILITIES

A. Perform testing on samples submitted by Contractor to testing laboratory.

B. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Contractor and Owner of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and tests required by Architect/Engineer.

G. Attend preconstruction conferences and progress meetings.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit 4 copies of laboratory report to Contractor, with 2 copies each to Architect/Engineer and Owner.

B. Include:
1. Data issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specification Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Compliance with Contract Documents.

C. When requested by Architect/Engineer, provide interpretation of test results.

1.6 LIMITS ON CITF AUTHORITY

A. CITF may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. CITF may not approve or accept any portion of the Work.

C. CITF may not assume any duties of Contractor.

D. CITF has no authority to stop the Work unless life-threatening health or safety conditions exist.

1.7 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

B. Cooperate with CITF personnel and provide access to the Project.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, and to facilitate tests and inspections, storage and curing of test samples.

D. Notify CITF and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF INSPECTIONS AND TESTS

The following list is not meant to be all inclusive. Refer to individual specification sections for testing requirements

A. Cast-In-Place Concrete

B. Masonry Mortar and Grout

C. Structural Steel Framing

D. Plumbing Systems Including Well and Septic Systems and Treatment Systems

E. Heating, Cooling, & Ventilation Systems

F. Electrical Systems

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes temporary facilities and controls needed for Work including, but not necessarily limited to:
   1. Temporary utilities such as heat, water, electricity, and telephone;
   2. Sanitary facilities;
   3. Enclosures such as tarpaulins, barricades, and canopies.
   4. Temporary access provisions

B. Exclusions from this Section:
   1. Equipment individual trades normally furnish to execute their own portions of Work are not part of this Section.
   2. Permanent installation and hookup of various utility lines are described in other Sections.

1.2 REQUIREMENTS

A. Specific administrative and procedural minimum actions are specified in this section, as extensions of provisions in the General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by the Architect that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. The Contractor shall be responsible for all temporary facilities, equipment, materials, and services necessary and incidental to the completion of the work of the Contract.

B. Provisions of this section are applicable to, but not by way of limitation, utility services, construction facilities, security/protection provisions, and support facilities.

1.3 QUALITY ASSURANCE

A. General: In addition to compliance with governing regulations and rules/recommendations of franchised utility companies, comply with specific requirements indicated and with applicable local industry standards for construction work.

B. NFPA Code: Comply with NFPA Code 241 "Building Construction and Demolition Operations".

1.4 JOB CONDITIONS

A. General: Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced the need.

B. Conditions of Use: Install, operate, maintain and protect temporary facilities in a manner and at locations which will be safe, non-hazardous, sanitary and protective of persons and property, and free of deleterious effects.

PART 2 - PRODUCTS

2.1 TEMPORARY UTILITY SERVICE

A. General: Where possible and reasonable, connect to existing franchised utilities for required services and comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services to minimize interference with construction operations.

B. Potable Water: Water connection (without charge) to Owner's existing potable water system is limited to one, ¾" pipe size connection, and a maximum flow of 10 GPM. Water usage shall be strictly limited to water required for on-site construction activities. Water required for the execution of the contract work, in volumes and pressure beyond that available at the site through the prescribed ¾" pipe at 10 gpm, shall be provided by the Contractor at no additional cost to the Owner.

C. Non-potable Water: Where non-potable water is used, mark each outlet with adequate health-hazard warning signs.

D. Temporary Power: Electrical power may be obtained by the Contractor from Owner's existing service in the building; but is limited to local 20-ampere rated circuits that are suited for small power tools. Any electrical power necessary to execute the work of the contract that is above and beyond the limits stated above shall be provided by the Contractor at no additional expense to the Owner.

2.2 TEMPORARY CONSTRUCTION FACILITIES

A. General: The types of temporary construction facilities required include, but not by way of limitation, the items listed below. Provide facilities reasonably required to perform construction operations properly and adequately.

B. Water Distribution: Pipe to each floor level and provide hose lengths sufficient to reach entire area of construction work, not less than 3/4" hose size. prevent freezing of water distribution by either prompt drainage after each use, or by suitable protection.

C. Enclosure: Provide temporary enclosure where reasonably required to ensure adequate workmanship and protection from weather and unsatisfactory ambient conditions for the work, including enclosure where temporary heat is used. Provide fire retardant treated lumber and plywood. Provide tarpaulins with UL label and flame spread of 15 or less.

D. Heating: Provide temporary heat to maintain temperatures required in each section of the Contract Documents. Heaters shall bear UL, FM approval labels appropriate for application.

E. Electrical Power: Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, lighting, and start-up testing of permanent electric powered equipment prior to its permanent connection to electrical system. Provide overload protection. Locate multiple outlets (not less than 4 gang) at each story of construction, spaced so that entire area of construction can be reached by power tools on a single extension cord of 100' maximum length.

F. Lighting:

1. Provide sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in task lighting. Provide

general lighting with local switching which will enable energy conservation during periods of varying activity.

2. Provide uniformly spaced general lighting equivalent to not less than one 200-watt incandescent lamp per 1000 square feet of floor area, and one 100-watt lamp per 50' of corridor and per flight of stairs.

G. Access Provisions:

1. Provide all necessary temporary access equipment including, but not limited to, stairs, ladders, scaffolding, cranes, platforms, man-lifts, and elevators. Provide access at all times for inspections of the Work by the Owner, Architect and agencies having jurisdiction.
2. Comply with reasonable requests of governing authorities performing inspections. When permanent stairs are available for access during construction, cover finished surfaces with sufficient protection to ensure freedom from damage and deterioration at time of substantial completion.

2.3 SECURITY AND PROTECTION PROVISIONS

A. General:

1. The types of temporary security and protection provisions required include, but not by way of limitation, the items listed in this section. These provisions are intended to minimize property loses, personal injuries and claims for damages at the project site.
2. Provide security/protection services and systems in coordination with activities and in a manner to achieve 24-hour, 7-day-per-week effectiveness.

B. Fire Extinguishers: Provide types, sizes, numbers, and locations as would be reasonably effective in extinguishing fires during early stages, by personnel at the project site. Provide type ABC dry chemical extinguishers at all locations; comply with recommendations of NFPA No. 10. Post warning and quick instructions at each extinguisher location, and instruct personnel at project site, at time of their first arrival, on proper use of extinguishers and other available facilities at project site. Post local fire department call number on each telephone instrument at project site.

C. Site Enclosure Fence: At earliest reasonable date enclose project site, or portion thereof sufficient to contain entire construction activity. Provide 6' high chain link steel fence with gates for both personnel and trucks, with locks held under strict security control.

D. Building Enclosure and Lockup: At the earliest possible date, secure building against unauthorized entrance at times when personnel are not working. Provide temporary enclosures at ground floor and other locations of possible entry, with locked entrances.

E. Environmental Protection Procedures: Provide facilities, establish procedures, and conduct construction activities in a manner which will ensure compliance with environmental regulations controlling construction activities at the project site. Designate one person, the Construction Superintendent, to enforce strict discipline on activities related to generation of wastes, pollution of air/water/soil, generation noise, and similar harmful or deleterious effects which might violate regulations or reasonably irritate persons at or in the vicinity of the project site.

F. Excavations: Provide temporary covers over open excavations when the jobsite is un-attended. Keep excavations covered at all times when it is raining. Do not allow rainwater to accumulate in open excavations

2.4 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Provide temporary traffic control devices, services, equipment and fixtures necessary to safely maintain and protect existing vehicular and pedestrian traffic adjacent to, and in anyway effected by, the work of the Contract.

B. Contractor shall provide manpower, barricades, flashing warning lights, flags, and traffic control personnel to effectively maintain safe conditions around the work, for occupants, pedestrians, vehicles and the public.

2.5 TEMPORARY SUPPORT FACILITIES

A. General: The types of temporary support facilities required include, but not by way of limitation, the items specified hereinafter, all as may be reasonably required for proficient performance of the work and accommodation of personnel at the site including Owner's and Architect's personnel. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities.

B. Contractor's Field Office: Provide adequate office space for field office personnel, suitably finished, furnished, equipped and conditioned. Include separate space for project meetings, with table(s) not less 4' x 12', and seating for not less than 10 persons.

C. Contractor’s Storage: The Contractor shall provide any and all means and methods for temporary storage on the site, including, but not limited to, storage trailers for materials required in the construction. The Owner will not provide any space for storage of the Contractor’s materials, equipment or tools. If the Contractor elects to store materials on the site in a temporary trailer, the storage units shall be enclosed in a fenced compound, constructed and maintained at the sole expense of the Contractor. The fence shall be a minimum 6’ tall chain link fence with lockable gates.

D. Sanitary Facilities: Contractor to provide either piped toilet facilities or self-contained toilet units of type acceptable to governing authorities, adequate for use of personnel at the project site. Provide separate facilities for male and female personnel when both sexes are working (in any capacity) at the project site.

E. Drinking Water: Provide drinking water, dispenser, cups and waste receptacles.

PART 3 - EXECUTION

3.1 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of Work.

B. Remove such temporary facilities and controls as rapidly as progress of Work will permit, or as Architect directs.

3.2 DE-WATERING

Provide temporary pumps, power source and accessories necessary to remove water from open excavations at all times.

END OF SECTION

SECTION 01 57 31

INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.

a. Control of emissions during construction.

2. Procedures for testing baseline IAQ or Building Flush-Out method. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

1.3 IAQ MANAGEMENT STRATEGY

A. The Owner has established that the contractor shall prevent indoor air quality problems resulting from the construction process, to sustain long term installer and occupant health and comfort.

B. Protect the ventilation system components during construction and clean contaminated components after construction is complete.

C. Control sources of potential IAQ pollutants by controlling selection of materials and processes used in project construction.

1.4 REFERENCES

A. Definitions: Definitions pertaining to sustainable development: As defined in ASTM E 2114.

1. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

2. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261.

a. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

3. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other

characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.

4. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, ceilings, and sealants.

5. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

6. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Conference: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop mutual understanding relative to details of environmental protection.

1.6 SUBMITTALS

A. Indoor Air Quality (IAQ) Management Plan: Prepare and submit an IAQ Management Plan including, but not limited to, the following:

1. Procedures for control of emissions during construction.

a. Identify schedule for application of interior finishes.

2. Procedures for moisture control during construction.

a. Identify porous materials and absorptive materials.

b. Identify schedule for inspection of stored and installed absorptive materials.

3. Revise and resubmit Plan as required by Architect

a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

B. Photographs documenting construction IAQ management measures implemented during construction such as duct protection measures and measures to protect on-site stored or installed absorptive materials from moisture.

C. Cut sheets of filtration media used during construction with MERV values highlighted.

1. Substitutions are not allowed unless approved by the Architect, in unique circumstances.

D. Provide on-site photographs documenting construction IAQ management measures to Architect for review.

E. Product Data:

1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).

2. Submit air pressure difference maps for each mode of operation of HVAC.

3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products.

a. Adhesives

b. Floor and wall patching/leveling materials

c. Caulking and sealants

d. Insulating materials

e. Fireproofing and firestopping

f. Carpet

g. Paint

h. Clear finish for wood surfaces

i. Lubricants

j. Cleaning products

F. Inspection and Test Reports:

1. Baseline Indoor Air Quality test report

PART 2 – PRODUCTS

2.1 GENERAL ENVIRONMENTAL ISSUES

A. Mold and Mildew: Materials that have evidence of growth of molds or mildew are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.

B. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove from site and dispose of properly.

2.2 AIR FILTRATION MEDIA

A. Minimum Efficiency Reporting Value (MERV) as determined by ASHRAE 52.2-2007:

1. MERV-8 for filtration media used at each return air grill, if used during construction.

2. MERV-13, for filtration media installed at the end of construction and prior to occupancy.

2.3 CLEANING PRODUCTS

A. Use low-toxic and lowest-emitting spot removers and cleaning agents for surfaces, equipment, and workers' personal use.

B. Use HEPA-filter equipped vacuum cleaners for the final cleaning.

PART 3 – EXECUTION

3.1 IAQ MANAGEMENT – EMISSIONS CONTROL

A. Construction Indoor Air Quality Management Plan: During construction operations, follow the recommendations in SMACNA "IAQ Guidelines for Occupied Buildings under Construction."

B. HVAC Protection:

1. Fit all return air grilles with temporary filters with a Minimum Efficiency Reporting Value (MERV) of 8.

2. Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).

3. Damper off the return system in the heaviest work areas and seal the return system openings with plastic.

4. Provide temporary exhaust during construction operations

5. Upgrade the filter efficiency where major loading is expected to affect operating HVAC system.

6. Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.

7. Replace all filtration media prior to occupancy.

C. Source Control:

1. Provide low and zero VOC materials as specified.

2. Do not use products in combination with or in contact with other products that can be identified as combining to form toxic fumes or sustained odors.

D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.

1. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.

2. Erect barriers between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas.

E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.

F. Temporary Ventilation: Provide an ACH (air changes per hour) of 1.5 or more and as follows:

1. Provide minimum 48-hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 deg F minimum to 90 deg F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Architect.

2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.

3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction and during OWNER occupancy. Coordinate with Work of Division 23, Heating, Ventilating, and Air Conditioning (HVAC).

a. Replace filters during construction as necessary to protect equipment and indoor air quality.

G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.

1. Do not use solvents within interior areas that may penetrate and be retained in absorptive materials such as concrete, gypsum board, wood, cellulose products, fibrous material, and textiles.

3.2 IAQ MANAGEMENT – IMPLEMENTATION OF PLAN

A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing the IAQ Management Plan for the Project.

1. Report all issues to General Contractor for immediate correction.

B. Progress Meetings: Construction related IAQ procedures shall be included in the pre-construction and construction progress meeting agendas.

C. Distribution: The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Owner, the Architect, and the Commissioning Agent.

D. Instruction: The Contractor shall provide on-site instruction of the IAQ procedures and ensure that all participants in the construction process understand the importance of the goals of the IAQ Management Plan.

E. Verification: Project Manager to fill out the Construction IAQ Management Plan Inspection Checklist with photographs of the measures in place during weekly site visits.

F. On-site Check-in Procedures: General Contractor and Subcontractor to review and agree on specified products and VOC limits before Subcontractor begins work using the VOC Verification Checklist. If any additional products not included in the project specifications are desired, the product must be approved for use by the Architect.

3.3 INDOOR AIR QUALITY ASSESSMENT – IAQ TESTING

After construction ends and before occupancy, but under ventilation conditions typical for occupancy, the contractor will conduct Baseline Indoor Air Quality Testing. All interior finishes, such as millwork, doors, paint, carpet, acoustic tiles, and movable furnishings (e.g., workstations, partitions), must be installed, and major VOC punch list items must be finished.

A. Baseline Indoor Air Quality Testing

1. After construction ends and before occupancy but under ventilation conditions typical for occupancy, conduct baseline IAQ testing in occupied spaces for the contaminants listed.

Table 1001.7.2
Maximum Concentration of Air Pollutants relevant to IAQ

Contaminant	Minimum Concentration, µg/m^3 (Unless Otherwise Noted)
Nonvolatile Organic Compounds	
Carbon monoxide (CO)	9 ppm and no greater than 2 ppm above outdoor levels
Ozone	0.075 ppm (2 h)
Particulates (PM 2.5)	35 (2 h)
Particulates (PM 10)	150 (2 h)
Volatile Organic Compounds	
Acetaldehyde	140
Acrylonitrile	5
Benzene	60
1,3-butadiene	20
t-butyl methyl ether (methyl-t-butyl ether)	8000
Carbon disulfide	800
Carbon tetrachloride	40
Chlorobenzene	1000
Chloroform	300
1,4-dichlorobenzene	800
Dichloromethane	400
1,4-Dioxane	3000
Ethylbenzene	2000
Ethylene glycol	400
Formaldehyde	33

n-Hexane	7000
Naphthalene	9
Phenol	200
4-phenylcyclohexene (4 PCH) [a]	2.5
2-propanol (isopropanol)	7000
Styrene	900
Tetrachloroethene (tetrachloroethylene, perchloroethylene)	35
Toluene	300
1,1,1-trichloroethane (methyl chlorofoam)	1000
Trichloroethene (trichloroethylene)	600
Xylene isomers	700
Total volatile organic compounds (TVOC)	_____ [b]

a. This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

b. TVOC reporting must be in accordance with CDPH/EHLB/Standard Method V1.1 and must be in conjunction with the individual VOCs listed

END OF SECTION

SECTION 01 58 13

TEMPORARY PROJECT SIGNAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Project Identification Sign.
- B. Project Informational Signs.
- C. Maintenance.
- D. Removal.

1.2 QUALITY ASSURANCE
- A. Erect Owner and Architect supplied signs and structures to withstand 75 miles/hour wind velocity.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS
- A. Structure and Framing: Use new wood products that are structurally adequate and comply with requirements of Section 06100.
- B. Rough Hardware: Galvanized, aluminum, or brass.

PART 3 - EXECUTION

3.1 INSTALLATION
- A. Pick-up, transport, and install Project identification sign and Architect's sign within 15 days after Notice to Proceed.
- B. Erect signs at location designated by the Owner and/or Architect.
- C. Erect supports and framing on secure foundation, rigidly braced, and framed to resist wind loadings.
- D. Install sign surface plumb and level with butt joints. Anchor securely.

3.2 PROJECT IDENTIFICATION SIGN
- A. One painted sign, by Owner, erected by Contractor. Set bottom edge 6 feet above ground.

3.3 MAINTENANCE
- A. Maintain signs and supports clean, repair deterioration and damages. Replace vandalized, damaged, missing, and stolen Project Identification or Architect signs.

3.4 REMOVAL
- A. Remove signs, framing, supports, and foundations at completion of Project, restore the area, and return signage to Owner and Architect.

3.5 CONTRACTOR SIGNS
- A. Contractor may erect one (1) sign on the project site to identify the General Contractor only. No other subcontractor, supplier, or manufacturer signs will be allowed on the site. The General Contractor shall remove signs that are not approved by the Owner or Architect immediately upon notification from the Owner or Architect.

END OF SECTION

SECTION 01 62 00

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section includes:
  1. Product Options
  2. Substitutions

1.2 PRODUCT OPTIONS
- A. For products that are specified by reference standards or by description only the Contractor has the option to utilize any product meeting those standards or description.

- B. For products specified by naming one or more manufacturers the Contractor has the option to utilize any of the manufacturers named and meeting the product specifications.

- C. For products specified by naming one or more manufacturers along with a provision for substitutions, the Contractor has the option to utilize any of the manufacturers named and meeting the product specifications; or submit a request for substitution for any manufacturer and product not named.

1.3 SUBSTITUTIONS
- A. Instructions to Bidders state time restrictions for submitting requests for substitutions during the bidding period.

- B. Submit requests in accordance with requirements specified in this Section. Substitution acceptance, if any, will be stated by addenda issued prior to Bid Date.

- C. Substitutions may be considered after award of Contract only when a product specified becomes unavailable through no fault of the Contractor.

- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. **Documentation shall include point by point comparison of specified product to proposed substitution.**

- E. A request constitutes a representation that the Bidder or Contractor:
  1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  2. Will provide the same warranty for the substitution as for the specified product.
  3. Will coordinate installation and make changes to other work which may be required for the Work to be completed with no additional cost to Owner.
  4. Waives claims for additional costs or time extension which may subsequently become apparent.

- F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without prior separate written request, or when acceptance will require revision to the Contract Documents.

- G. Substitution Submittal Procedure:
  1. Submit Request for Substitution for consideration. Limit each request to one proposed substitution.
  2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence through documentation that includes a point by point comparison of the proposed substitution to the specified product.

3. The Architect will make notification in writing, of decision to accept or reject request.

I. Determination of Approved Equal:
The term “Approved Equal” , as it is used in the Contract Documents, shall be interpreted as an opportunity for the Contractor to substitute a product that is equal to the specified product in all regards, subject to approval by the Architect of the substitution. The burden for researching the market place and finding an “Approved Equal” product shall be the sole responsibility of the Contractor. The use of the term “Approved Equal” shall in no way be interpreted to mean that an equal product is currently manufactured or available. The use of the term “Approved Equal” is intended to communicate to the Contractor that the Architect has not conducted an exhaustive search to find equal products, but the Contractor has the opportunity to do so.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SUBSTITUTION REQUEST

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request. The data includes a point by point comparison of the characteristics and all components of proposed substitution product compared to the same characteristics of the specified product.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. All provisions of Section 01 62 00 apply to this substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

SUBMITTED BY:

Signature _____ For use by the design consultant

Firm _____ [ ] Accepted [ ] Accepted as noted

Address _____ [ ] Not Accepted [ ] Received too late

_____ By _____

Date _____

Telephone _____ Remarks _____

Attachments:

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE & HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaging and Transportation.

B. Delivery and Receiving

C. Product Handling

D. Storage, General

E. Enclosed Storage

F. Exterior Storage

G. Maintenance of Storage

H. Protection of Finished Work

I. Repair and Replacement

PART 2 – PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 TRANSPORTATION AND HANDLING

A. Packaging and Transportation

1. Require supplier to package finished products in boxes or crates for protection during shipment, handling, and storage. Protect sensitive products against exposure to elements and moisture.
2. Protect sensitive equipment and finishes against impact, abrasion, and other damage.

B. Delivery and Receiving

1. Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.
2. Coordinate deliveries to avoid conflict with Work and conditions at site; limitations on storage space; availability of personnel and handling equipment; and Owner's use of premises.
3. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.
4. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents, to permit easy accumulation of parts, and to facilitate assembly.
5. Immediately upon delivery, inspect shipment to assure:
   a. Product complies with requirement of Contract Documents and reviewed submittals.
   b. Quantities are correct.
   c. Accessories and installation hardware are correct.
   d. Containers and packages are intact and labels legible.
   e. Products are protected and undamaged.

C. Product Handling
1. Provide equipment and personnel to handle products, by methods to prevent soiling and damage.
2. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
3. Handle product by methods to avoid bending or overstressing. Lift large and heavy components only at designated lift points.

3.2 STORAGE AND PROTECTION

A. General
1. Store products immediately upon delivery in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.
2. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.
3. Stored materials must not conflict with work conditions. On-site storage methods and locations subject to Owner's approval.

B. Staging and Site Allocation of Storage Space:
The Contractor shall submit a plan to the Owner that illustrates the Contractor's intended use of the site during construction of the work. The Contractor shall not proceed with any use or occupancy of the site without the Owner's approval of the staging plan.

C. Enclosed Storage
1. Store products subject to damage by the elements in substantial weathertight enclosures.
2. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
3. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.
4. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

D. Exterior Storage
1. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products form soiling and staining.
2. Products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.
3. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
4. Provide surface drainage to prevent erosion and ponding of water.
5. Prevent mixing of refuse or chemically injurious materials or liquids.

E. Maintenance of Storage
1. Periodically inspect stored products on a scheduled basis.
2. Verify that storage facilities comply with manufacturer's product storage requirements.
3. Verify that manufacturer-required environmental conditions are maintained continually.
4. Verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.

F. Maintenance of Equipment Storage
1. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.
2. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a Record Document.

G. Storage of Owner's Salvaged Furnishings and Equipment
Contractor shall provide temporary storage facilities for items to be salvaged and re-installed.

3.3 PROTECTION OF FINISHED WORK

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Protect finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

C. Keep finished surfaces clean, unmarred, and suitably protected until accepted by owner.

3.4 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs at no additional cost to Owner.

B. Additional time required to secure replacements and to make repairs will not justify an extension in Contract Time of Completion, unless Owner authorizes such extension.

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 01 11 00 "Summary of Work" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Project Engineer-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Certified Surveys: Submit [two] copies signed by professional engineer.

C. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit digital copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

A. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, 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. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

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. Other Construction Elements: Do not cut and patch other construction elements or 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

4. 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. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field

measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a professional engineer experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control

points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Final Property Survey: Engage a professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

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

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place 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 weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 01 10 00 "Summary of Work" for other requirements for Owner-furnished, Contractor-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal.

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

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: This Section establishes general requirements pertaining to cutting, fitting, and patching of Work required to:
   1. Make the several parts fit properly.
   2. Remove and/or uncover existing finishes or structures to provide for installation or inspection of new work.
   3. Patch existing finishes and structures in connection with new work.
   4. Remove and replace work not conforming to requirements of Contract Documents.
   5. Remove and replace defective work.

B. Related work:
   1. In addition to other requirements specified, upon Architect's request uncover work to provide for Architect's inspection of covered work, and remove samples of installed materials for testing.
   2. Do not cut or alter work performed under separate contracts without Architect's written permission.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Request for Architect's consent:
   1. Prior to cutting that affects structural safety, submit written request to Architect for permission to proceed with cutting.
   2. Should conditions of Work or schedule indicate required change of materials or methods for cutting and patching, notify Architect and secure the Architect's written permission.

B. Notice to Architect: Submit written notice to Architect designating time Work will be uncovered, to provide for Architect's observation.

1.4 PAYMENT OF COSTS

A. Perform cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications. If not identified in other sections of these specifications, provide material to match adjacent construction.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General
   1. Where cutting of any structural member is required and such cutting is not indicated or specified, first obtain Architect's written acceptance for each location. Also obtain written approval from local building officials, if required by local building code.
   2. Contractor shall locate and arrange for cutting of openings and chases through walls, floors, and ceilings in advance of need. Avoid unnecessary or excessive cutting. Where cutting of finished surface is required, make cuts neatly along true lines to avoid need for patching. Where possible, make holes and other cuts so they will be concealed by finished work and where they will be least conspicuous. Work in place damaged or defaced by cutting shall be restored to original conditions so such damage or defacement is undetectable upon completion.
   3. Do not cut and patch structural work in a manner resulting in reduction of load carrying capacity or load/deflection ratio. Do not cut and patch operational elements and safety related components in a manner resulting in decreased operational life, increased maintenance, or decreased safety. Do not cut and patch work which is exposed on the exterior or exposed in occupied spaces of the building, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut and patch work, both as judged solely by the Architect. Remove and replace work judged by the Architect to be cut and patched in a visually unsatisfactory or otherwise objectionable manner.
   4. Where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete work.
   5. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.
   6. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.
   7. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coats.

B. Materials: Except as otherwise indicated or approved by the Architect, provide materials for cutting and patching which will result in equal or better work than work being cut and patched; in terms of performance characteristics and including visual effect where applicable. Use materials identical with original materials where feasible and where recognized that satisfactory results can be produced thereby.

C. Scope of Cutting and Patching Work: The Contractor shall perform all cutting and patching required and necessary to accomplish the construction of all improvements described in the Contract Documents, at no additional cost to the Owner.

3.2 TEMPORARY SUPPORT AND PROTECTION

A. Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work. Provide adequate protection of other work during cutting and patching, to prevent damage; and provide protection of the work from adverse weather exposure.

3.3 SURFACE CONDITIONS

A. Inspection:
   1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
   2. After uncovering work, inspect conditions affecting installation of new work.

B. Discrepancies:
   1. If uncovered conditions are not as anticipated, immediately notify Architect and secure needed directions.
   2. Do not proceed until unsatisfactory conditions are corrected.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Throughout construction period, maintain buildings and site in standard of cleanliness as described in this Section.

B. Related work: In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Conduct daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

B. In addition to standards described in this Section, comply with pertinent requirements and standards.

1.3 SAFETY REQUIREMENTS

A. Standards: Maintain project in accordance with safety and insurance requirements and standards.

B. Hazard Control: Store volatile wastes in covered metal containers and remove from premises daily. Prevent accumulation of waste that creates hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on project site. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain specified standard of cleanliness.

2.2 COMPATIBILITY

A. Use only cleaning materials and equipment compatible with surface being cleaned as manufacturer of material recommends.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:

1. Retain stored items in orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of the Work.
3. At least twice each month, and more often if necessary, completely remove all scrap,

debris, and waste material from job site.

4. Provide adequate storage for all items awaiting removal from job site, observing requirements for fire prevention and protection of ecology.

B. Site:
1. Daily, and more often if necessary, inspect site and pick up all scrap, debris, and waste material. Remove such items to place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on site. Restack, tidy, or otherwise arrange to meet requirements of the contract documents.
3. Maintain site in neat and orderly condition at all times.
4. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish. Clean mud, dirt, and debris resulting from building operation from drives, roads, and lots as required, and maintain access roads to site in good condition.
5. Provide on-site dumpster containers for collecting waste materials, debris, and rubbish. Remove snow and ice from public walkways and public access of buildings.
6. **Contractor shall inspect the site at the end of each work day and collect all deleterious objects and materials resulting from construction activities including, but not limited to, nails, screws, and other sharp objects.**

C. Structures:
1. Weekly, and more often if necessary, inspect structures and pick up all scrap, debris, and waste material. Remove such items to place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean," for purpose of this subparagraph, is interpreted as meaning free from dust and other material capable of being removed by reasonable effort and hand-held broom.
3. As required to prepare for installing succeeding materials, clean structures or pertinent portions thereof to degree of cleanliness recommended by manufacturer of succeeding material, using equipment and materials required to achieve necessary cleanliness.
4. Following installation of finish floor materials, protect and keep floor clean at all times.
5. Or clean daily while work is being performed in pace in which finish materials are installed.
   a. “Clean," for purpose of this subparagraph, is interpreted as meaning free from foreign material which, in Architect’s opinion, may injure finish floor material.

3.2 FINAL CLEANING

A. "Clean," for purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning level of cleanliness generally provided by skilled cleaners using commercial-quality building maintenance equipment and materials.

B. Prior to completing Work, remove from job site all tools, surplus materials, equipment, scrap, debris, and waste.

C. Site: Unless Architect specifically directs otherwise, broom clean paved areas on site and public paved areas adjacent to site, where debris and dirt are the result of Contractor’s work.

D. Structures - Clean to remove debris and dirt caused by Work of Contract:
1. Exterior:
   a. Visually inspect exterior of surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
   b. Remove all traces of splashed materials from adjacent surfaces.
   c. If necessary to achieve uniform degree of cleanliness, hose down exterior of

structure.

d. In event of stubborn stains not removable with water, Architect may require light pressure washing or other cleaning at no additional cost to Owner.

2. Interior:
   a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
   b. Remove all traces of splashed material from adjacent surfaces.
   c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass: Clean inside and outside.
4. Polished surfaces: To surfaces requiring routine application of buffed polish, apply polish recommended by manufacturer of material being polished.

E. Inspection and Schedule:
   1. In preparation for substantial completion or occupancy, conduct final inspection of exposed interior and exterior surfaces and of concealed spaces.
   2. Schedule final cleaning as approved by Architect to enable Owner to accept completely clean Work.

F. If Contractor fails to clean up at completion of work, Owner may do so and charge cost to Contractor.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for waste reduction and for the recycling of non- hazardous, recyclable, construction and demolition debris.
   1. Reduce waste by minimizing factors that contribute to waste.
   2. Follow the Waste Management Plan and use reasonable and legal means to divert a minimum of 90% of the total construction and demolition materials from landfills and incineration
   3. Do not generate more than 10 pounds of new construction waste per square foot (50 kilograms of waste per square meter) of the building's floor area. Divert at least 90% of all renovation and demolition waste.

1.2 DEFINITIONS

A. Waste Reduction: Construction practices that achieve the most efficient use of resources and materials; uses water efficiently; avoids practices such as over- packaging, improper storage, ordering errors, poor planning, breakage, mishandling and contamination.

B. Construction and Demolition Waste: Solid wastes arising from demolition or removal, excess or unusable construction materials, packing materials for construction products, and other materials generated on site during the construction process but not incorporated into the Work.

C. Recyclable Materials: Construction and demolition debris that can be recovered and processed into new products or materials. Recyclable materials include, but are not limited to, the following:
   1. Metals: Ferrous (iron, steel, stainless steel, galvanized steel) and non-ferrous (copper, brass, bronze, aluminum) types and containers made from metals such as pails, buckets, and beverage cans.
   2. Asphaltic concrete paving
   3. Concrete
   4. Gypsum wallboard
   5. Paper products such as those generated from field office activities and clean corrugated packaging cardboard.
   6. Wood products, including untreated dimensional lumber, plywood, oriented strand board, hardboard, particleboard, and crates and pallets made from wood products.
   7. Brick and stone masonry.
   8. Carpet and padding.
   9. Plastics and containers made from plastics such as pails, buckets, and beverage bottles.
   10. Copper wiring
   11. Glass beverages containers, window and mirror glass.

D. Non-Recyclable Materials: Construction and demolition debris not capable of being reused or reprocessed, exclusive of the recyclable materials listed above.

E. Hazardous Materials: Construction and demolition debris that are regulated for disposal by local, city, county, state, or Federal authorities.

F. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.3 SUBMITTALS

A. Construction Waste Management Plan: Submit the proposed waste management program appended to the bid. The program shall include the following:
   1. Identification of Contractor's staff responsible for enforcing construction waste management.
   2. Actions that will be taken to reduce solid waste generation.
   3. Description of the specific methods to be used in recycling/reuse of the various construction and demolition debris generated, including the areas and equipment, to be used for processing, sorting, and temporary storage of debris.
   4. Characterization, including estimated types and quantities of the construction and demolition debris to be generated. Include percentage of recyclable and non-recyclable debris.
   5. List of specific construction and demolition debris materials that will be salvaged for resale, salvaged and reused, or recycled.
   6. Name(s) of landfill and incinerator to be used and the estimated costs for use, for construction and demolition debris that is unable to be recycled or reused.
   7. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used and excess construction materials such as materials exchange networks and Habitat for Humanity.
   8. Identification of local recycling facilities that will accept construction and demolition debris.
   9. Identification of constructions and demolition debris that cannot be recycled/reused with an explanation or justification.
   10. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the construction and demolition debris and avoided landfill and incineration costs.

B. Wate Management Reports: With each Application for Payment, submit a Waste Management Report in a form acceptable to the Architect and owner. Attach manifests, weight tickets, receipts and invoices. Organize and maintain records to document the following:
   1. Quantity of debris generated, for each material recycled, reused or salvaged.
   2. Quantity of debris diverted through sale, reuse, or recycling, in tons or cubic yards.
   3. Quantity of debris disposed by landfill or incineration.
   4. Name and location of each firm accepting the debris, including:
      a. Types of debris accepted
      b. Date of acceptance
   5. Transportation cost for removal of debris from job site.

6. Amount of money paid or received for the recycled, reused, or salvaged materials.
7. Net total cost or saving recycling, reusing or salvaging materials.

C. Project Closeout: Upon project completion submit the Waste Management Records to the owner.
   1. Submit evident that non-hazardous construction and demolition has been recycled and salvaged. Calculations can be done by weight or volume, but must be consistent throughout.

1.4 QUALITY ASSURANCE

A. Construction Wate Management: Prior to bid, prepare a program that minimizes waste and diverts construction and demolition debris from landfills and incinerators by facilitating their reuse or recycling. Name the waste material processors who will accept the construction and demolition debris, the condition of the construction and demolition debris required by the waste material processors, the method proposed to provide the construction and demolition debris in suitable condition and in a quantity acceptable to the disposal sites and waste material processors whom will receive them, and the impact on the project schedule. The Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to the recycling of waste. Revenues or other savings obtained from sale, reuse, and recycling operations shall accrue to the Contractor.

B. Disposal Sites and Waste Material Processors: Use only facilities with valid legal permits for disposal, recycling and waste processing issued by the jurisdictions in which they are located.

C. Pre-Construction Waste Management Meeting: Prior to beginning site preparation, schedule and conduct a meeting to review the waste management program. The meeting shall include the Contractor, the Architect, the Owner and any of the Contractor's subcontractors or suppliers whose work will interface with the program. The agenda shall include a discussion of procedures, schedules and specific requirements for construction and demolition debris, sale, reuse, recycling, and disposal. Make any revisions to the program that are agreed to as a part of the meeting and submit the revised program and the meeting minutes to the Architect and Owner for their records.

D. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

B. General: For the duration of the project implement and maintain construction waste management. During the prosecution of the Work encourage the practice of efficient waste reduction when sizing, cutting, and installing products and materials.

C. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

F. Transportation: Arrange for the regular collection, transport from the site, and delivery of the construction wastes and debris to the designated recyclers, and waste material processors and disposal sites.

G. Separation Facilities: The Contractor shall provide on-site instruction of appropriate separation, handling separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the Project. Provide and designate an on-site area for the separation of construction and demolition debris for reuse and recycling. Locate the area in order that non-recyclable debris will not contaminate materials to be reused or recycled. Provide containers and bins in the designated area to facilitate separation, storage and handling which are clearly and appropriately marked. Cut all items to lengths and sizes to fit within the containers or bins provided. Where there is sufficient quantity of a specific recyclable debris item (for example; salvaged metal doors and frames or duct work), make arrangements for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Maintain the separation facilities in an orderly condition to prevent contamination of materials placed therein and to maximize reuse and recyclability of debris. Separate construction and demolition debris at the project site by one of the following methods:
1. Source Separated Method: Construction and demolition debris, that is reusable and recyclable, are separated from non-recyclable debris and sorted into appropriately marked separated containers or bins and then transported to the designated recycling facility for further processing. Non-recyclable debris is transported to a landfill or incinerator.
2. Co-Mingled Method: All construction and demolition debris is placed into containers or bins and then transported to a recycling facility where recyclable and salvageable materials are removed, sorted, and processed and the remaining waste is transported to a landfill or incinerator.

3.2 RECYCLING GENERAL WASTE

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

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 DISPOSAL OF WASTE

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

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION

SECTION 01 75 00

STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Procedures for starting of mechanical and electrical systems.

1.2 QUALITY CONTROL
- A. Require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment installation prior to start-up; to supervise placing equipment in operation; and to provide a written report that equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting lines or anchor bolts, and has been satisfactorily operated under full load conditions.

1.3 SUBMITTALS
- A. Submit preliminary schedule listing times and dates for start-up of each item of equipment in sequence 2 weeks prior to proposed dates.

- B. Submit manufacturer's representative reports within 1 week after start-up, listing satisfactory start-up dates.

1.4 PROJECT CONDITIONS
- A. Building enclosure is complete weathertight and substantially complete.

- B. Excess packing and shipping bolts are removed.

- C. Interdependent systems have been checked and are operational.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION
- A. Verify that Project conditions comply with requirements.

- B. Verify that status of Work meets requirements for starting of equipment and systems.

3.2 PREPARATION
- A. Coordinate sequence for start-up of various items of equipment.

- B. Notify Owner 7 days prior to start-up of each item of equipment.

- C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.

- D. Verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, and other conditions that may cause damage.

- E. Verify that control systems are fully operational in automatic mode.

- F. Verify that tests, meter readings, and specific electrical characteristics agree with those specified by electrical equipment manufacturer.

G. Verify that wiring to motors and controls required by mechanical work for operational smoke and fire protection demonstrations is complete.

H. Verify that wiring and support systems for equipment installed under separate contracts is complete and checked.

I. Bearings: Inspect for cleanliness; clean and remove foreign matter. Verify alignment; take corrective measures.

J. Drives: Inspect for tension on belt drives, adjustment of varipitch sheaves and drives, alignment, proper equipment speed, and cleanliness. Take corrective action.

K. Motors: Verify that motor amperage agrees with nameplate value. Inspect for conditions that produce excessive current flow and that exist due to equipment malfunction. Take corrective action.

3.3 STARTING SYSTEM

A. Execute start-up under supervision of responsible manufacturer's representative and the CITF.

B. Place equipment in operation in proper sequence in accordance with sequencing schedule.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

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

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

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.5 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment in accordance with the Owner’s requirements for payment procedures
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
    a. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit **by** uploading to web-based project software site

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
d. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
e. Vacuum and mop concrete.
f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
h. Remove labels that are not permanent.
i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
l. Clean ducts, blowers, and coils.

m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
n. Clean strainers.
o. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit **by** uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect'scomments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 36

WARRANTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation and submittal of warranties.

B. Schedule of submittals.

1.2 FORM OF SUBMITTALS

A. Bind in commercial quality 8-1/2-inch by 11-inch, three-ring "D" type ring binders, with hardback, cleanable plastic covers; 3-inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings and provide table of contents in each binder.

B. Label cover of each binder with typed or machine printed title WARRANTIES with title of Project, Project number, name, address, and telephone number of Contractor; and name of responsible principal.

C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual; with each item identified with the number and title of the Specification Section in which specified, and the name of Product or Work item.

D. Separate each warranty with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List sub-contractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.3 PREPARATION OF SUBMITTALS

A. General: Verify with other specifications Sections for required warranties.

B. Obtain warranties, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of Work. Except for items placed into service with Owner's permission, leave date for beginning of warranty time blank until the Date of Substantial Completion is accepted by the Architect and Owner.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals, when required. Provide originals for each warranty. Photostatic copies are not acceptable.

E. Retain warranties until time specified for submittal.

1.4 TIME OF SUBMITTALS

A. Warranties for completed and accepted work shall be dated the same date as the Certificate of Substantial Completion.

B. For items of Work where acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints and one set of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned Record Prints and three sets of file prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. 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, as follows:
    1. Format: Annotated PDF electronic file with comment function enabled.
    2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
    3. Refer instances of uncertainty to Architect for resolution.
    4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
    1. Format: Annotated PDF electronic file with comment function enabled.

2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

1.4 RECORD SPECIFICATIONS.

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 43

EXTRA STOCK MATERIALS AND SPARE PARTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products required.

B. Storage and delivery of products.

1.2 PRODUCTS REQUIRED

A. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in other Sections to be furnished to Owner, in addition to requirements for completion of Work.

B. Products: Identical to those installed in the Work. Include extra stock and spare parts in the original purchase and shipment of the products being installed in the project.

1.3 PACKAGING AND DELIVERY

A. Packaging:

1. Spare parts and stock materials shall be boxed and packaged in the manufacturer's original packaging. For loose parts, the Contractor shall box the parts in cardboard boxes.
2. All containers shall be labeled with information that clearly identifies the contents, including, but not limited to, description of the product, part numbers, size, color, and manufacturer's contact information.

B. Coordinate Delivery with Owner: Deliver itemized products and unload spare products to Owner at the project site, or where directed by Owner. Obtain receipt for delivery and provide the Owner with a copy of the receipt.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner**,** through Architect, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.

1. Submit video recordings by uploading to web-based Project software site.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes: Labor, equipment, materials, and accessories necessary for and reasonably incidental to completion of selective demolition and removals as shown on Drawings and as herein specified.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled work men who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work.

B. Comply with standards specified and as required by all agencies having jurisdiction.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work prior to commencing Work. Do not proceed until unsatisfactory conditions are corrected.

B. Contractor shall accept site and buildings thereon and contents thereof in condition in which they may be when released to contractor. Any hazardous materials not included in the contract scope of work that might be discovered shall be responsibility of Contractor to notify the Owner immediately and request direction for further action.

3.2 PROTECTION

A. Proper precaution shall be taken at all times to protect vehicular and pedestrian traffic from any damage or injury which may be caused, either directly or indirectly by Work of this Section. Do not obstruct traffic.

B. Demolition will take place around occupied buildings. A method for control and scheduling of loud noises shall be developed and followed to assure minimum inconvenience to neighboring occupants. Protect improvements on adjoining properties as well as those on Owner's property.

3.3 SALVAGE AND RE-USE OF EXISTING CONSTRUCTION

A. If required, temporarily remove and reinstall existing items of construction scheduled to remain.

B. Carefully remove, tag, protect, and store existing materials and components scheduled or proposed for re-use. Obtain Architect's written approval of each component or batch of materials before such re-use is executed.

3.4 DEMOLITION

A. Remove existing construction as indicated on Drawings and as required to accommodate alterations and new construction indicated on Drawings.

B. Provide planking, bridges, fences, bracing, shoring, barriers, warning signs, and lights as required to afford protection specified herein. Post easily readable warning signs in adequate number, conspicuously around all hazardous areas. Make periodic inventory of protective devices to insure continuous protection.

C. Shoring and bracing: When removing any structural supports, install shoring, struts, bracing, and other protection as required to prevent collapse of walls, floors or framing and to maintain safety for workmen and public. Use of salvaged material for shoring or bracing will not be permitted.

D. Execute work in quiet, careful, and orderly manner, with least possible disturbances. Perform demolition work in such manner as to avoid hazard to persons and property. Demolish masonry and concrete in small sections. Remove individually, and carefully lower structural members.

E. Exercise care when separating parts to be removed from those to remain, so that minimum of restoration will be required. Where cutting of finished surfaces is indicated, or required, make cuts neatly along true lines.

F. Exercise care when removing materials and equipment scheduled or proposed for re-use or to be retained by Owner and protect against damage or loss. Equipment and materials should be removed by trade involved.

G. Provide any patching and repairs required.

H. Regularly remove debris and refuse and legally dispose of it off site. Do not burn any material or debris on site.

I. **Contractor shall inspect the site at the end of each work day and collect deleterious objects and material resulting from demolition activities including, but not limited to, nails, screws, and other sharp objects.**

3.5 REPLACEMENTS

A. All construction to remain, which is damaged by demolition and removal operations under this Section, shall be restored and repaired to Architect's satisfaction at no additional cost to Owner. Where voids are created by removals or cutting, fill and repair such voids as required to provide sound, complete continuous surfaces.

B. Should any public or private property be disturbed or damaged as a result of Contractor's operation, contractor shall at contractor’s own cost and expense, restore such property to condition equivalent to that which existed before damage was done, to Architect’s satisfaction.

3.6 DISPOSAL

A. Except for materials and equipment scheduled for re-use or to be salvaged for Owner, assume ownership of all materials and equipment demolished and/or removed and legally dispose of same off-site.

END OF SECTION

SECTION 02 82 00

ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:

1. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor for the safe removal and proper disposal of asbestos-containing materials (ACM) affected/disturbed by the work. ACM were identified in the Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC. The types, locations and quantities of ACM known and assumed to be present are detailed in the Hazardous Materials Survey and are also identified in this Section.
2. Quantities presented in this Section are estimates only. The Contractor shall field verify quantities prior to submitting a bid or accept the estimates as accurate. No changes to quantities will be permitted after bids are received, with the exception of hidden material being identified during the course of the project or a change in conditions.
3. Requirements of this Section are designed for the safe removal and disposal of ACM and assumed ACM. Regulatory standards and best industry practices may contain other requirements that must be followed.
4. The Contractor must adhere to the requirements of the Maryland Department of the Environment (MDE) and view any MDE determinations as final.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Sections:

1. Section 02 89 00 – Abatement Monitoring

B. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
   a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
      1) 29 CFR 1910 Subpart I – Personal Protective Equipment
      2) 29 CFR 1910.12 – Construction Work

3) 29 CFR 1910.134 – Respiratory Protection
4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)
5) 29 CFR 1910.1020 – Access to Employee Exposure and Medical Records
6) 29 CFR 1910.1200 – Hazard Communication
7) 29 CFR 1926 – Safety and Health Regulations for Construction
8) 29 CFR 1926 – Subpart AA – Confined Spaces in Construction
9) 29 CFR 1926 Subpart E – Personal Protective and Life Saving Equipment
10) 29 CFR 1926.35 – Employee Emergency Action Plans
11) 29 CFR 1926.59 – Hazard Communication
12) 29 CFR 1926.1101 – Asbestos in Construction

b. U.S. Environmental Protection Agency (EPA)
1) 40 CFR 61, Subpart M – National Emission Standards for Hazardous Air Pollutants (NESHAP), National Emission Standards for Asbestos
2) 40 CFR 763 – Asbestos Hazard Emergency Response Act (AHERA)

c. U.S. Department of Transportation (DOT)
1) 49 CFR 171-177, 180 – Hazardous Materials Regulations

2. State:
a. Code of Maryland Regulations (COMAR)
1) COMAR 26.11.21 – Control of Asbestos
2) COMAR 26.11.23 – Asbestos Accreditation of Individuals
3) COMAR 26.13 – Disposal of Controlled Hazardous Substances

1.4 DEFINITIONS

A. Terms defined by OSHA Regulation 29 CFR 1926.1101 or by EPA Regulation 40 CFR Part 61, Subpart M have the same meaning when used in this Section.

1.5 SUBMITTALS AND NOTICES

A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer's written approval indicating that the submittal is returned for unrestricted use.
1. Contact Information and Licenses/Qualifications
a. Asbestos Abatement Contractor
1) Project contact sheet for key personnel including names, cell phone numbers, e-mail addresses, and roles and responsibilities
2) Asbestos Abatement License (non-expired)
3) Liability insurance certificate with the types and amounts of coverage that comply with the requirements outlined in the Contract
4) Certification signed by an officer of the abatement contracting firm that exposure measurements, medical surveillance, and worker training records are being maintained in conformance with 29 CFR 1926
5) Certification signed by an officer of the abatement contracting firm that the respiratory protection program is being maintained in conformance with 29 CFR 1910.134
6) Record(s) of any citation(s) issued by Federal, State, and Local regulatory agencies relating to asbestos abatement activity by the Contractor within the past 5 years. Contractor must include projects, dates, and resolutions

b. Abatement Supervisor(s) and Workers
1) Resume of abatement supervisor(s) demonstrating a minimum of 2 years of experience supervising abatement projects and including project descriptions for at least 3 similar types of projects

2) Non-expired training certification, non-expired Maryland accreditation, non-expired medical clearance, and non-expired fit test documentation for supervisor(s) and all workers

c. Waste Disposal
1) Company, contact name, phone number, address, license of transporter to haul asbestos waste, and certificate of insurance
2) Company, contact name, phone number, address, license or permit of landfill to accept asbestos waste, and certificate of insurance
3) If non-regulated ACM will be disposed of in a construction and demolition (C&D) landfill, submit a letter from the landfill indicating that they will accept the waste.

2. Abatement Work Plan – The Abatement Work Plan shall be prepared by an AHERA Project Designer. The Work Plan shall include but not be limited to the following:
a. Notification – Provide copy of notification(s) submitted to MDE/EPA, as applicable.

b. Signs – Identify the number of 3-day signs required (as required by COMAR 26.11.21), identify the locations of 3-day signs, and schedule for posting 3-day signs.

c. For each regulated area, describe location, signs to be posted, means to control access, and means to capture debris from the work.

d. Describe engineering controls that will be utilized to prevent the release of asbestos into the environment. Engineering controls may include but are not limited to the following: critical barriers, drop cloths, glovebags, negative pressure enclosures, negative air pressure ventilation/filtration HEPA equipment, HEPA equipped vacuum cleaners, wet removal methods, encapsulation methods, and enclosure methods.

e. List all required personal protective equipment. For respirator, describe respirator and cartridge type.

f. Describe work procedures including the method that will be used to remove each type of ACM.

g. Describe procedures for bagging and removal of wastes, including how waste will be moved from the roof to the ground, if applicable to the work.

h. Describe temporary storage facility for waste prior to removal from the site, including description of signs on storage facility.

3. Equipment and Supplies
a. Safety Data Sheets for all chemicals to be used

b. Equipment specification sheets demonstrating all negative air filtration units are equipped with HEPA filters

4. Emergency Plans
a. An emergency plan that meets the requirements of 29 CFR 1926.35

B. During abatement activities, the Contractor shall submit the following to the Engineer:

1. Copies of all waste shipment records on the same day that the waste is picked up
2. The Contractor shall maintain on-site daily job progress reports detailing abatement activities including a review of the estimated percentage of completion, major problems or delays and taken or planned corrective action, injury reports, equipment breakdowns, etc. A compiled copy shall be submitted after the work is completed.
3. The Contractor shall maintain on-site daily work-site entry logbooks with information on worker and visitor access. A compiled copy shall be submitted after the work is completed.
4. The Contractor shall maintain on-site air monitoring records that shall be made available to Engineer upon request. A compiled copy shall be submitted after the work is completed.

C. Upon completion of abatement activities, the Contractor shall submit the following to the Engineer:
1. Statement of completion of compliance with specifications
2. Compiled set of daily job progress reports
3. Compiled set of daily work-site entry logs
4. Final waste disposal manifests signed by the waste disposal facility
5. Compiled set of air monitoring data/records and IH daily logs, including clearance sampling

1.6 ASBESTOS HEALTH RISK

A. Where in the performance of the work, the Contractor's workers or supervisory personnel, its Subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified ACM, take appropriate continuous measures as necessary to protect all building occupants from the risk of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable Federal, State, and Local agencies.

1.7 WORKER TRAINING AND ACCREDITATION REQUIREMENTS

A. AHERA Project Designer: All Project Designers are to be trained as required by the EPA Model Accreditation Plan (40 CFR Part 763, Subpart E, Appendix C) and accredited by MDE as Project Designers.

B. AHERA Supervisor Accreditation: All Supervisors are to be trained as required by the EPA Model Accreditation Plan (40 CFR Part 763, Subpart E, Appendix C) and accredited by MDE as Abatement Supervisors.

C. AHERA Worker Accreditation: All Workers are to be trained as required by the EPA Model Accreditation Plan (40 CFR Part 763, Subpart E, Appendix C) and accredited by MDE as Abatement Workers.

1.8 MEDICAL SURVEILLANCE REQUIREMENTS

A. All employees who will perform asbestos work and/or wear a respirator shall participate in a medical surveillance program meeting the requirements of 29 CFR 1926.1101 and 29 CFR 1910.134 as applicable.

1.9 WARNING LEVELS AND STOP WORK LEVELS

A. Inside Work Area (Area and Personal Monitoring):
1. The Warning Level for any sample taken shall be 25% of the Maximum Use

Concentration as defined by OSHA in 29 CFR 1910.134. If airborne concentrations for any one sample exceed the Warning Level, the abatement contractor shall revise work procedures to lower airborne contaminant levels.

2. The Stop Work Level shall be 50% of the Maximum Use Concentration (as defined by OSHA in 29 CFR 1910.134) for any one sample or 25% of the Maximum Use Concentration for the Time Weighted Average (TWA) of any work shift or 8-hour period. Work shall be stopped and a plan developed to address the exceedance. The plan must be approved by the Certified Industrial Hygienist of the third-party Industrial Hygiene Contractor to be retained by the Abatement Contractor. Do not recommence work until authorized in writing by the Certified Industrial Hygienist and the Engineer.

B. Outside Work Area:

1. The Stop Work Level shall be 10% of the Permissible Exposure Limit for asbestos or the background level, whichever is greater. If airborne concentrations for any one sample exceed this Stop Work Level, work shall be stopped and a plan developed to address the exceedance. The plan must be approved by the Certified Industrial Hygienist. Do not recommence work until authorized in writing by the Certified Industrial Hygienist and the Engineer. If the exceedance was the result of a failure of work area isolation measures, initiate the following actions:
   a. Immediately stop all abatement work.
   b. Contact Certified Industrial Hygienist for direction.
   c. Notify Engineer.
   d. Evaluate possible sources of contamination.
   e. Repair damaged containment.
   f. As directed by the Certified Industrial Hygienist, decontaminate surfaces outside of the containment that may have been contaminated.
   g. Collect outside sample(s).
   h. If outside sample(s) are less than the Stop Work Level, re-start abatement. If outside sample(s) fails, repeat steps d. through g.

1.10 AUTHORITY TO STOP WORK

A. The Owner's Representative, the Industrial Hygiene Contractor (third-party, retained by Contractor), or the Engineer have the authority to issue a work stoppage at any time during the abatement work if the Owner's Representative, Industrial Hygiene Contractor, or Engineer deems that conditions are in violation of these specifications or any Federal, State, or Local regulations.

B. Once a work stoppage has been issued, the Contractor shall take corrective steps including but not limited to the following:
   1. Cease all asbestos removal activities, or any activities that disturb ACM.
   2. Repair any fallen, ripped or otherwise failed work area isolation measures.
   3. Maintain in operation work area isolation measures.
   4. Maintain all worker protection.
   5. Fog the air in the work area with a mist of amended water to reduce airborne fiber levels.

C. The Contractor shall not recommence work until conditions have been corrected and authorized in writing by the party who issued the stop work order.

D. Delays, stand-by time, and expenses necessary for Contractor to take corrective action, resolve any violations of these specifications or applicable laws shall be at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide equipment in quantities necessary to accomplish the work of this Section, including but not limited to the following:
   1. Negative air filtration units with HEPA filters
   2. Vacuum units with HEPA filters
   3. Low-pressure water sprayers

B. Provide materials in quantities necessary to accomplish the work of this Section, including but not limited to the following:
   1. Amended Water
      a. Provide water to which a surfactant has been added.

      b. Use a mixture of surfactant and water which results in adequately wetting the ACM by use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

   2. Encapsulants
      a. Encapsulants (sealants) designed for asbestos abatement

   3. Polyethylene Sheeting
      a. Polyethylene sheeting designed for asbestos abatement with a minimum 6-mil thickness

      b. Polyethylene sheeting shall be designated as fire resistant by the manufacturer

   4. Disposal Bags
      a. Disposal bags shall include required OSHA, EPA, and DOT asbestos labels

      b. Disposal bags shall be a minimum of 6-mil thick, leak-tight, and made of polyethylene

   5. Other Materials
      a. Duct tape in 2” or 3” widths, with an adhesive which is formulated to aggressively stick to polyethylene sheeting

      b. Spray adhesive, which is specifically formulated to stick tenaciously to polyethylene sheeting

2.2 PERSONAL PROTECTIVE EQUIPMENT

A. As required by OSHA and as applicable to the work hazards encountered, personal protective equipment including but not limited to foot protection, hand protection, head protection, hearing protection, eye and face protection, etc. shall be worn by all site workers.

B. In addition, person(s) conducting the removal of ACM are required to be made aware of the health hazards associated with asbestos and wear appropriate personal protective equipment in the work area(s) including but not limited to:
   1. Disposable full-body coveralls (provide sufficient quantity for all required changes)
   2. Disposable hand, head and foot covers (provide sufficient quantity for all required changes)
   3. Respiratory protection (refer to 2.3 as follows)

C. In addition, disposable full-body coveralls and disposable hand, head and foot covers shall be provided by the Contractor for the Engineer, emergency personnel, and other authorized representatives who may inspect the site.

2.3 RESPIRATORY PROTECTION

A. The Contractor shall provide at no cost to the employee respiratory protection against airborne concentrations of asbestos during this abatement project.

B. The Contractor's respiratory protection program shall be in place in accordance with the Contractor's submittal as detailed in Section 1.5 and in compliance with 29 CFR 1910.134.

C. Respirators are required to be used for all asbestos work.

2.4 HYGIENE FACILITIES AND PRACTICES

A. The Contractor shall respectively provide and implement hygiene facilities and practices in accordance with 29 CFR 1926.1101(j).

PART 3 - EXECUTION

3.1 ASBESTOS-CONTAINING MATERIAL TYPE(S) AND ESTIMATED QUANTITIES

Material Type	Estimated Quantity	Action
9" x 9" Floor Tile	6,090 Square Feet	Remove Affected Items
Joint Compound	2,702 Square Feet	Remove Affected Items
Mastic on Covebase	363 Linear Feet	Remove Affected Items
Expansion Joint	126 Linear Feet	Remove Affected Items
Paper Wrap Around Ceiling Joist	8 Square Feet	Remove Affected Items
Window Glazing	140 Linear Feet	Remove Affected Items
Pipe Flange Gasket (Assumed)	3 Each	Remove Affected Items
Fire Door (Assumed)	3 Each	Remove Affected Items

A. Contractor may elect to sample materials assumed to contain asbestos in a manner sufficient to document whether it contains asbestos or not. If any material is found not to contain asbestos, the Contractor may submit results to the Engineer with a request that the requirements of this Section not apply to the removal of the material.

3.2 METHODS OF COMPLIANCE

A. Contractor shall adhere to the approved Abatement Work Plan.

3.3 ENGINEERING AND WORK PRACTICE CONTROLS

A. The Contractor shall implement engineering and work practice controls to reduce and maintain employee exposure below the Permissible Exposure Limit (PEL of 0.1 f/cc) to the extent that such controls are feasible. Engineering and work practice controls shall be reviewed and approved by the Engineer. Respirators are required for all asbestos abatement even if engineering controls maintain exposures below the PEL.

B. All abatement work shall be done using wet methods. Amended water shall be sprayed on all materials to be removed during this procedure and shall continue to be sprayed on the material until placed into a waste container or roll-off.

C. A HEPA vacuum shall be used as an engineering control to pre-clean before abatement begins, during abatement activities, and as part of final cleanup activities.

D. Perform prompt cleanup of debris as it is generated during abatement activities and perform daily cleanup of work areas.

E. Refer to paragraph 3.8 for minimum daily cleanup requirements.

3.4 SIGNAGE AND WARNINGS

A. The Contractor shall display 3-Day notice signs as required by MDE at all entrances into the building.

B. The Contractor may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this specification. The Contractor shall assure that no statement appears on or near any sign required by this specification, which contradicts or detracts from the meaning of the required sign.

C. Warning signs that demarcate the regulated area shall be provided and displayed by the Contractor. A regulated area is defined as an area where an employee's exposure may be above the PEL.

D. Warning signs shall also be required outside the work area at the secured waste storage location.

E. Warning signs shall be posted at such a distance from such a location that an employee or other authorized personnel may read the signs and take necessary protective steps before entering the area marked by the signs.

F. Warning signs are required by 29 CFR 1926.1101.Z.(k).(7).(ii).[A] and shall bear the following information:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

G. Warning signs are required by 29 CFR 1926.1101.Z.(k).(7).(ii).[B] and shall bear the following information where the use of respirators and protective clothing are required in the regulated area:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY
WEAR RESPIRATORY PROTECTION AND PROTECTIVE
CLOTHING IN THIS AREA

H. The Contractor shall assure that all signs are illuminated and cleaned as necessary so that the text is readily visible.

3.5 LABELS

A. The Contractor shall affix the label(s) to all products and containers containing asbestos waste, including waste disposal bags, containers, and/or drums.

1. The label(s) shall be clearly visible printed in large, bold letters on a contrasting background. The label(s) are required by 29 CFR 1926.1101.Z.(k).(8).(iii) and shall bear the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

2. The labels shall also specify the date the bag was sealed, license number of the Contractor, name of the waste generator, and address of the project.

3.6 SITE PREPARATION

A. Site preparation prior to abatement consists of the following steps:

1. Post signs on all entrances into the building 3 days prior to abatement as required by regulations.
2. Post warning signs at entrances and exits to work areas and secured waste storage areas.
3. Remove or protect all furnishings.
4. Set up containment necessary to protect surfaces and contain dust and debris.
5. Pre-clean all surfaces in the work areas.
6. Provide a wash area for the crew at the site. All members of the abatement crew must wash after removing and properly disposing of their protective clothing.

3.7 ABATING THE ACM

A. Removal of ACM shall be performed according to Contractor's approved Abatement Work Plan and applicable regulations.

3.8 DAILY CLEANUP

A. All asbestos waste must be bagged at the end of each day and any asbestos debris on the floor must be HEPA vacuumed at the end of each day.

B. All supplies and equipment must be maintained in a neat and orderly condition.

C. The daily cleanup activities shall be scheduled for the end of each work shift after active abatement has ceased, and sufficient time must be allowed for a thorough and complete cleanup. Under no circumstances shall active abatement be proceeding while the daily cleanup is in progress.

3.9 FINAL CLEARANCE PROCEDURES

A. All waste must be bagged and all bags removed from the work area.

B. All dust and debris must be removed from all surfaces.

C. The third-party Industrial Hygiene Contractor shall perform a final visual inspection.

D. Perform any additional cleaning required by the third-party Industrial Hygiene Contractor.

E. Encapsulate area as required in the Abatement Work Plan.

F. The third-party Industrial Hygiene Contractor shall perform final clearance air sampling as required by COMAR 26.11.21.

3.10 STORAGE OF ACM WASTE

A. The Contractor shall make provisions for the safe and secured storage of waste on-site prior to disposal. For security reasons, waste storage areas must be treated as regulated areas and access shall be restricted.

B. Asbestos waste must be removed within 24 hours of completion of the asbestos abatement for Non-NESHAP size projects or within seven (7) days of completion for NESHAP size projects.

3.11 DISPOSAL OF ACM WASTE

A. Execution

1. All waste shall be maintained in adequately wet condition and sealed in leak-tight containers.
2. Prior to removing waste from the work area, each bag of waste shall be sealed and placed entirely within a second bag, which shall also be sealed in a manner to prevent leakage. Refer to paragraph 3.5 for labeling requirements.
3. All waste is to be hauled by a waste hauler with all required licenses from all Federal, State, and Local authorities.
4. Load all ACM waste material in disposal bags, leak-tight drums, or other containers as described in Contractor's Abatement Work Plan.
5. Post "Danger Asbestos” signs on vehicle while loading.
6. Protect interior of truck or dumpster with a double-layer of 6-mil polyethylene sheeting.
7. Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate vehicles for transport. Exercise care before and during transport to ensure that no unauthorized persons have access to the material.
8. Complete a waste manifest at the time of shipment. Contractor's competent person shall sign the "Generator's Certification" unless directed otherwise. Submit copy of pickup receipt to Engineer on each day that waste is shipped.

B. Disposal

1. Regulated ACM waste shall be disposed at a licensed asbestos landfill. ACM that is not regulated may be disposed at a construction and demolition (C&D) landfill that has agreed to accept the material. All selected disposal locations shall be approved by the Engineer, prior to transport and disposal of the waste.
2. Sealed plastic bags may be carefully unloaded from the truck. If bags are broken or damaged, return to work-site for re-bagging within a containment area; the entire truck and contents must be cleaned using damp cleaning methods and mopping or with a HEPA vacuum.

3. After completion of delivery, the truck must be cleaned using damp cleaning methods and mopping or with a HEPA vacuum.
4. Contractor shall retain receipts from landfill for material delivered for disposal.
5. The Contractor shall, no later than 45 days after shipment of each load, submit copy(s) of waste manifest and landfill receipt to the Engineer.

3.12 PROJECT COMPLETION

A. The Abatement Contractor shall remove all equipment, supplies, and waste from the site.

B. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 02 83 00

IMPACT TO LEAD PAINTED SURFACES, REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:

1. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor for lead-safe work practices and the proper disposal of waste materials containing lead in paint affected/disturbed by the work. Lead-containing paints, including lead-based paint by definition, were identified within the limits of the work, as reported in the Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC.
2. The Contractor and its Subcontractors shall comply with OSHA's Lead in Construction Standard, 29 CFR 1926.62.
3. Components with painted surfaces not otherwise reported in the above-referenced survey report shall be presumed to contain lead in paint.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Sections:

1. Section 02 89 00 – Abatement Monitoring

B. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
   a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
      1) 29 CFR 1910 Subpart I – Personal Protective Equipment
      2) 29 CFR 1910.12 – Construction Work
      3) 29 CFR 1910.134 – Respiratory Protection
      4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)
      5) 29 CFR 1910.1200 – Hazard Communication
      6) 29 CFR 1926 – Safety and Health Regulations for Construction
      7) 29 CFR 1926 Subpart AA – Confined Spaces in Construction
      8) 29 CFR 1926 Subpart E – Personal Protective and Life Saving Equipment
      9) 29 CFR 1926.59 – Hazard Communication
      10) 29 CFR 1926.62 – Lead

b. U.S. Environmental Protection Agency (EPA)
   1) 40 CFR 117.3 – Determination of Reportable Quantities
   2) 40 CFR 260 – Hazardous Waste Management System: General
   3) 40 CFR 261 – Identification and Listing of Hazardous Waste
   4) 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste
   5) 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste
   6) 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
   7) 40 CFR 268 – Land Disposal Restrictions: General
   8) 40 CFR 302 – Designation, Reportable Quantities, and Notification
   9) SW-846 – Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium

c. U.S. Department of Transportation (DOT)
   1) 49 CFR 171-177, 180 – Hazardous Materials Regulations

2. State:
   a. Code of Maryland Regulations (COMAR)
      1) COMAR 26.13 – Disposal of Controlled Hazardous Substances
      2) COMAR 26.16 – Lead

1.4 DEFINITIONS

A. Terms defined by OSHA Regulation 29 CFR 1926.62 and COMAR Regulation 26.16 have the same meaning when used in this Section.

1.5 SUBMITTALS AND NOTICES

A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer's written approval indicating that the submittal is returned for unrestricted use.
   1. Lead Compliance Program (Program). The Program must meet the requirements of 29 CFR 1926.62 (e) for the Contractor and each Subcontractor who will disturb lead in paint at any concentration. The elements of the Program shall include but are not necessarily limited to the following:
      a. A description of each activity in which lead is emitted

      b. A description of the means to be used to achieve compliance

      c. Information on the technology considered to comply with the permissible exposure limit

      d. Air monitoring data that documents the source of lead emissions

      e. A detailed schedule for implementing the Program

      f. A work practice program which includes items required under paragraphs (g), (h), and (i) of 29 CFR 1926.62

      g. An administrative control schedule required by paragraph (e)(4) of 29 CFR 1926.62, if applicable

      h. A description of arrangements made among contractors on multi-contractor sites to inform affected employees of potential lead exposures

2. Lead Waste Management Plan (Plan). This Plan must identify each waste stream impacted by lead-containing paint and state how each such waste stream will be handled for waste disposal. Examples of potential waste streams include but are not limited to construction and demolition debris coated with lead-containing paint, disposable personal protective equipment, plastic drop cloths, paint stripping waste, and dust and chips from paint. For each waste stream, the Plan shall include the following:
   a. Means of secure on-site storage of waste while it is accumulated

   b. Testing protocol. The Plan must indicate how the Contractor will determine if the waste stream is hazardous for lead. The Plan must indicate who will collect samples, how samples will be collected, the laboratory that will analyze the samples, the analytical method, and the standard/regulation to which the analytical results will be compared.

   c. Training certificate for Contractor personnel who will handle or ship hazardous waste as required by 49 CFR 172 Subpart H, the hazardous waste shipping regulation of the U.S. Department of Transportation

   d. Methods of packaging and labeling of waste streams

   e. A copy of the shipping manifest that will accompany hazardous waste. Provide the generator's (Owner's) Resource Conservation and Recovery Act (RCRA) identification number that will be used, the proper shipping name of the waste, and indicate how the Owner's signature will be obtained for the manifest.

   f. Hazardous waste transportation company and contact information, RCRA identification number, and certificate of insurance

   g. Transfer facility (if any) and contact information, RCRA identification number, and certificate of insurance

   h. Final disposal facility and contact information, RCRA identification number, and certificate of insurance

   i. All metal waste coated with lead-based paint shall be recycled at an appropriately certified and permitted facility.

3. Training
   a. Provide documentation of worker training in accordance with 29 CFR 1926.62(l)(2).

1.6 LEAD HEALTH RISK

A. Where in the performance of the work, the Contractor's workers or supervisory personnel, its Subcontractors, or its consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified lead-containing paint, take appropriate continuous measures as necessary to protect all building occupants from the risk of exposure to lead. Such measures shall include the procedures and methods described herein and compliance with applicable Federal, State, and Local regulations.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide equipment in quantities necessary to accomplish the work of this Section including but not limited to the following:
   1. Negative air filtration units with High Efficiency Particulate Air (HEPA) filters
   2. Vacuum units with HEPA filters
   3. Heat gun operating below 1,100°F
   4. HEPA vacuum blaster
   5. HEPA vacuum needle gun

B. Provide materials in quantities necessary to accomplish the work of this Section including but not limited to the following:
   1. Polyethylene Sheeting
      a. Polyethylene sheeting with a minimum thickness of 6-mil
      b. Polyethylene sheet designated as fire resistant by the manufacturer
   2. Disposal Bags
      a. Disposal bags with a minimum thickness of 6-mil, leak-tight, and made of polyethylene
   3. Disposal Drums
      a. DOT waste disposal drums in accordance with 49 CFR 173
   4. Cleaning Solution
      a. At least 1 ounce of 5 percent trisodium phosphate to each gallon of water
   5. Other Materials
      a. Duct tape in 2” or 3” widths, with an adhesive which is formulated to aggressively stick to polyethylene sheeting
      b. Spray adhesive, which is specifically formulated to stick tenaciously to polyethylene sheeting
      c. Chemical strippers

2.2 PERSONAL PROTECTIVE EQUIPMENT

A. As required by OSHA and as applicable to the work hazards encountered, personal protective equipment including but not limited to foot protection, hand protection, head protection, hearing protection, eye and face protection, etc. shall be worn by all site workers.

B. In addition, workers conducting the removal of lead in paint are required to be made aware of the health hazards associated with lead and wear appropriate personal protective equipment in the work area(s) including but not limited to the following:
   1. Disposable full-body coveralls (provide sufficient quantity for all required changes)
   2. Disposable hand, head, and foot covers (provide sufficient quantity for all required changes)
   3. Respiratory protection (refer to 2.3 as follows)

C. In addition, disposable full-body coveralls and disposable head, hand and foot covers shall be provided by the Contractor for the Engineer, emergency personnel, and other authorized representatives who may inspect the site.

2.3 RESPIRATORY PROTECTION

A. The Contractor shall provide at no cost to the employee, respiratory protection against airborne concentrations of lead.

B. The Contractor's respiratory protection program shall be in place in accordance with the Contractor's submittal as detailed in Section 1.5 and in compliance with 29 CFR 1910.134.

2.4 HYGIENE FACILITIES AND PRACTICES

A. The Contractor shall provide and implement hygiene facilities and practices in accordance with 29 CFR 1926.62(i).

PART 3 - EXECUTION

3.1 METHODS OF COMPLIANCE

A. The Contractor shall adhere to the approved Lead Compliance Program and Lead Waste Management Plan.

3.2 PROJECT COMPLETION

A. The Contractor shall remove all equipment, supplies, and waste from the site.

B. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 02 84 00

POLYCHLORINATED BIPHENYL (PCB) EQUIPMENT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:

1. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor for the safe removal and proper disposal of equipment containing Polychlorinated Biphenyls (PCBs) affected/disturbed by the work. Equipment containing PCBs was identified within the limits of the work, as reported in in the Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC. The types, locations and quantities of PCB equipment are provided in the Hazardous Materials Survey and are also identified in this Section.
2. Light ballasts labeled as “Non-PCB” shall be recycled.
3. Quantities presented in this Section are estimates only. The Contractor shall field verify quantities prior to submitting a bid or accept the estimates as accurate. No changes to quantities will be permitted after bids are received, with the exception of hidden equipment being identified during the course of the project or a change in conditions.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Sections:

1. Section 02 89 00 – Abatement Monitoring

B. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 REFERENCES AND APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and all of its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
   a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
      1) 29 CFR 1910 Subpart I – Personal Protective Equipment
      2) 29 CFR 1910.12 – Construction Work
      3) 29 CFR 1910.134 – Respiratory Protection
      4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)

5) 29 CFR 1910.1200 – Hazard Communication
6) 29 CFR 1926 – Safety and Health Regulations for Construction
7) 29 CFR 1926 Subpart AA – Confined Spaces in Construction
8) 29 CFR 1926 Subpart E – Personal Protective Equipment
9) 29 CFR 1926.59 – Hazard Communication

b. U.S. Environmental Protection Agency (EPA)
1) 40 CFR 260 – Hazardous Waste Management System: General
2) 40 CFR 261 – Identification and Listing of Hazardous Waste
3) 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste
4) 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste
5) 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
6) 40 CFR 761 – Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

c. U. S. Department of Transportation (DOT)
1) 49 CFR 171-177, 180 – Hazardous Materials Regulations

2. State:
a. Code of Maryland Regulations (COMAR)
1) COMAR 26.13 – Disposal of Controlled Hazardous Substances

1.4 DEFINITIONS
A. Terms defined by EPA Regulation 40 CFR 761 have the same meaning when used in this Section.

1.5 SUBMITTALS AND NOTICES
A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer's written approval indicating that the submittal is returned for unrestricted use.
1. Work Plan – The Work Plan shall include but not be limited to the following:
a. Project contact sheet for key personnel including names, cell phone numbers, and e-mail addresses for:
1) Abatement Contractor

b. Describe work procedures for removal of each type of PCB equipment.

c. List all required personal protective equipment.

d. Describe lockout/tagout procedures.

e. Describe temporary waste storage procedures, including the following: type of container(s), labeling of container(s), and temporary storage location for container(s).

f. Describe transportation and disposal procedures, including the following:
1) The name and address of the waste disposal facility where wastes will be disposed, including copy of facility license/permit and certificate of insurance
2) The name and address of the transporter that will transport waste to the waste disposal facility, including copy of transporter license/permit and certificate of insurance
3) EPA Identification Numbers of waste transporter and disposal facility
4) A sample of the disposal label that will be used

5) The name and address of the recycling facility for Non-PCB light ballasts, including copy of facility license/permit

g. Describe emergency spill response procedures.

2. Liability insurance certificate with the types and amounts of coverage that comply with the requirements outlined in the Contract

B. During work, the Contractor shall submit the following to the Engineer:
1. Copies of all waste manifests on the same day that the waste is picked up by waste transporter

C. Upon completion of work, the Contractor shall submit the following to the Engineer:
1. Final waste disposal manifests signed by the waste disposal/recycling facility

1.6 PCB HEALTH RISKS

A. Where in the performance of the work, the Contractor's workers or supervisory personnel, its Subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified PCBs, take appropriate continuous measures as necessary to protect all building occupants from the risk of exposure to PCBs. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable Federal, State and Local agencies.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide materials and equipment in quantities necessary to accomplish the work, including but not limited to the following:
1. Disposal bags: 6-mil thick, leak-tight polyethylene bags
2. Small quantity storage containers: Five (5) gallons or less capacity for small quantity waste segregation, manufactured with structurally durable materials compatible with the waste type(s)
3. DOT waste disposal drums in accordance with 49 CFR 173

2.2 PERSONAL PROTECTIVE EQUIPMENT

A. As required by OSHA and as applicable to the work hazards encountered, personal protective equipment including but not limited to foot protection, hand protection, head protection, hearing protection, eye and face protection, etc. shall be worn by all site workers.

B. In addition, person(s) conducting the removal of equipment known to contain or presumed to contain PCBs are required to be aware of the possible health hazards associated with the handling of PCBs and wear appropriate PPE including but not limited to the following:
1. Chemical resistant eye goggles
2. Disposable full-body coveralls
3. Rubber boot covers or steel-toe rubber boots
4. Chemical resistant gloves (e.g., neoprene, nitrile, etc., as appropriate for waste stream)

PART 3 - EXECUTION

3.1 PCB EQUIPMENT TYPE(S) AND ESTIMATED QUANTITIES

Equipment Type	Estimated Quantity	Action
Ballast (Assumed)	92 Each	Remove Affected Items

3.2 METHODS OF COMPLIANCE

A. The Contractor shall adhere to the approved Work Plan.

3.3 STORAGE, TRANSPORTATION, AND DISPOSAL OF PCB EQUIPMENT

A. Storage, transportation, and disposal of PCB equipment shall be conducted in accordance with all applicable regulations including but not limited to the following: 40 CFR 761 Subpart D (Storage and Disposal); 40 CFR 260, et al. (Federal regulations governing hazardous waste); DOT regulations 49 CFR Subchapter C (Hazardous Materials Regulations); and COMAR 26.13 (Disposal of Controlled Hazardous Substances).

B. Waste containers shall be labeled in accordance with applicable regulations, including but not limited to the marking requirements and formats identified in 40 CFR 761, Subpart C (Marking of PCBs and PCB Items).

C. Before shipment of waste materials:
   1. The Contractor shall verify that the Owner has an EPA Identification Number for the work to be performed as part of this specification. Federal regulation 40 CFR 761.202 requires that a Generator of PCBs possess an EPA Identification Number.
   2. An EPA Uniform Hazardous Waste Manifest must be completed in accordance with 40 CFR 761.207. This manifest will contain information regarding the type and quantity of waste, the Generator/Owner, the Transporter, and the ultimate destination of the waste, as well as each party's EPA Identification Number. Each party involved in any part of the generation, transportation, and disposal of the waste material must be given and keep available a copy of the shipping manifest.

3.4 RECORD KEEPING

A. All record keeping shall be performed in accordance with applicable requirements listed in 40 CFR 761 Subpart J, General Records and Reports, Section 761.180.

B. All paperwork associated with the removal, transportation, and disposal of the PCB equipment is required to be retained by the Generator/Owner for a period of no less than three (3) years after the removal and include the following:
   1. Generator/Owner Information
   2. Equipment Information (Make, Model, ID number, and total number of each type)
   3. Waste Transportation Company Information
   4. Copy of the Uniform Hazardous Waste Manifest
   5. Waste Disposal Site/Facility Information
   6. Reports of Analysis (if applicable)

3.5 PROJECT COMPLETION

A. The Contractor shall remove all equipment, supplies, and waste from the site.

B. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 02 87 00

OZONE-DEPLETING SUBSTANCES EQUIPMENT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:

1. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor for the removal and disposal of equipment containing Ozone-Depleting Substances identified in the Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC. The types, locations and quantities of equipment containing Ozone-Depleting Substances are detailed in the Hazardous Materials Survey and are also identified in this Section.
2. Quantities presented in this Section are estimates only. The Contractor shall field verify quantities prior to submitting a bid or accept the estimates as accurate. No changes to quantities will be permitted after bids are received, with the exception of hidden material identified during the course of the project or a change in conditions.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
    a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
        1) 29 CFR 1910 Subpart I – Personal Protective Equipment
        2) 29 CFR 1910.12 – Construction Work
        3) 29 CFR 1910.134 – Respiratory Protection
        4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)
        5) 29 CFR 1910.1200 – Hazard Communication
        6) 29 CFR 1926 – Safety and Health Regulations for Construction
        7) 29 CFR 1926 Subpart AA – Confined Spaces in Construction
        8) 29 CFR 1926 Subpart E – Personal Protective and Life Saving Equipment
        9) 29 CFR 1926.59 – Hazard Communication

b. Environmental Protection Agency (EPA)
1) 40 CFR 82 – Protection of Stratospheric Ozone

1.4 DEFINITIONS

A. Ozone-Depleting Substances mean a group of chemicals that include chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), and other halogenated chemicals such as halons that are found to contribute stratospheric ozone layer depletion.

B. Appliance means any device which contains and uses a Class I (CFC) or Class II (HCFC) substance or substitute as a refrigerant and which is used for household or commercial purposes, including any air conditioner, motor vehicle air conditioner (MVAC), refrigerator, chiller, or freezer.

C. Opening an appliance means any service, maintenance, repair, or disposal of an appliance that would release any refrigerant in the appliance to the atmosphere. Connecting and disconnecting hoses and gauges to measure pressures, add refrigerant, or recover refrigerant from the appliance are not considered "opening an appliance."

D. Technician means any person who in the course of maintenance, service, or repair of an appliance (except MVACs) could be reasonably expected to violate the integrity of the refrigerant circuit and therefore release refrigerants into the environment. Technician also means any person who in the course of disposal of an appliance (except small appliances, MVACs, and MVAC-like appliances) could be reasonably expected to violate the integrity of the refrigerant circuit and therefore release refrigerants from the appliances into the environment.

E. Reclaim means to reprocess recovered refrigerant to all of the specifications in Appendix A of 40 CFR Part 82, Subpart F (based on AHRI Standard 700 2016, Specifications for Refrigerants) that are applicable to that refrigerant and to verify that the refrigerant meets these specifications using the analytical methodology prescribed in Section 5 of Appendix A of 40 CFR Part 82, Subpart F.

1.5 SUBMITTALS AND NOTICES

A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer’s written approval indicating that the submittal is returned for unrestricted use.
1. Work Plan – Describe work procedures including the method that will be used to remove Ozone-Depleting Substances from each type of appliance. Include name and address of facility(ies) where the Ozone-Depleting Substances and equipment will be recycled.
2. Certifications – Provide copies of Technician Certifications.
3. Liability insurance certificate with the types and amounts of coverage that comply with the requirements outlined in the Contract

B. Upon completion of work, the Contractor shall submit the following to the Engineer:
1. Documentation of all equipment from which Ozone-Depleting Substances were reclaimed on-site.
2. Documentation of all equipment from which Ozone-Depleting Substances were reclaimed off-site.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 EQUIPMENT CONTAINING OZONE-DEPLETING SUBSTANCES AND ESTIMATED QUANTITIES

Equipment Type	Estimated Quantity	Action
Air-Conditioning Unit	2 Each	Remove Affected Item
Air-Condensing Unit	1 Each	Remove Affected Item
Household Refrigerator	1 Each	Remove Affected Items
Commercial Refrigerator	2 Each	Remove Affected Items

3.2 METHODS OF COMPLIANCE

A. The Contractor shall adhere to the approved Work Plan.

3.3 PROHIBITION ON VENTING

A. Under the Code of Federal Regulations 40 CFR Part 82, individuals are prohibited from knowingly venting Ozone-Depleting Substances into the atmosphere while maintaining, servicing, repairing, or disposing of appliances.

3.4 SERVICE PRACTICE REQUIREMENTS

A. Evacuation Requirements

1. Air-conditioning and refrigeration equipment must be evacuated to EPA-required vacuum level prior to opening. If the technician's recovery or recycling equipment was manufactured on or after November 15, 1993, an EPA-approved equipment testing organization must certify the equipment. Refrigerant recovery and recycling equipment manufactured before November 15, 1993, may be grandfathered if it meets the standard detailed in 40 CFR 82.158.

B. Reclamation Requirement

1. EPA has established that refrigerant recovered and/or recycled can be returned to the same system or other systems owned by the same person without restriction. If refrigerant changes ownership, however, that refrigerant must be reclaimed.

C. Equipment Certification

1. EPA has established a certification program for refrigerant recovery and recycling equipment. EPA requires that persons servicing or disposing of air-conditioning and refrigeration equipment certify to the EPA that they have acquired (built, bought, or leased) recovery or recycling equipment and that they are complying with the applicable requirements of this rule. Owners do not have to send in a new form each time they add recycling or recovery equipment to their inventory. Certification of refrigerant recovery and recycling equipment manufactured on or after November 15, 1993, can be identified by a label reading “This equipment has been certified by Air-conditioning, Heating & Refrigeration Institute (AHRI) and Underwriters Laboratories (UL) to meet EPA's minimum requirements for recycling and/or recovery equipment intended for use.” Lists of certified equipment might be obtained by contacting AHRI and UL.

D. Technician Certification
   1. EPA has established a certification program for technicians who perform maintenance, service, repair, or disposal that could be reasonably expected to release refrigerants into the atmosphere. All technicians must be certified through the EPA-approved training program.

3.5 DISPOSAL OF EQUIPMENT CONTAINING OZONE-DEPLETING SUBSTANCES

A. All major equipment containing Ozone-Depleting Substances must have their Ozone-Depleting Substances recovered prior to dismantling. Small units that will enter the waste stream intact, such as freezers and window air conditioners, shall have their refrigerant recovered prior to waste pick up.

B. If refrigerants are recycled or reclaimed, they are not considered hazardous under federal regulations. In addition, used oils contaminated with CFCs are not considered hazardous on the following conditions:
   1. They are not mixed with other waste.
   2. They are subject to CFC recycling or reclamation.
   3. They are not mixed with used oils from other sources.
   4. Used oils that contain CFCs after the CFC reclamation procedure, however, are subject to specific limits for used oil fuels if these oils are destined for burning.

C. After Ozone-Depleting Substances have been recovered, evacuated equipment shall be recycled.

3.6 RECORD KEEPING

A. All records must be retained for at least 3 years.

B. Contractors disposing of small appliances must maintain a copy of signed statements from the appliance supplier (e.g., the original owner or disposal contractor) if the supplier indicates that they have removed the refrigerant from the appliance.

3.7 PROJECT COMPLETION

A. The Contractor shall remove all equipment, supplies, and waste from the site.

B. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 02 88 00

UNIVERSAL WASTE REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Work Includes:

1. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor for the safe removal and proper disposal of Universal Wastes affected/disturbed by the work. Universal Wastes were identified within the limits of the work, as identified in the Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC. The types, locations and quantities of Universal Wastes are detailed in the Hazardous Materials Survey and are also identified in this Section.
2. Quantities presented in this Section are estimates only. The Contractor shall field verify quantities prior to submitting a bid or accept the estimates as accurate. No changes to quantities will be permitted after bids are received, with the exception of hidden material identified during the course of the project or a change in conditions.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Sections:

1. Section 02 89 00 – Abatement Monitoring

B. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and all its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
    a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
        1) 29 CFR 1910 Subpart I – Personal Protective Equipment
        2) 29 CFR 1910.12 – Construction Work
        3) 29 CFR 1910.134 – Respiratory Protection
        4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)
        5) 29 CFR 1910.1200 – Hazard Communication
        6) 29 CFR 1926 – Safety and Health Regulations for Construction
        7) 29 CFR 1926 Subpart AA – Confined Spaces in Construction

8) 29 CFR 1926 Subpart E – Personal Protective and Life Saving Equipment
9) 29 CFR 1926.59 – Hazard Communication

b. U.S. Environmental Protection Agency (EPA)
1) 40 CFR 260 – Hazardous Waste Management System: General
2) 40 CFR 273 – Universal Waste Regulations

c. U.S. Department of Transportation (DOT)
1) 49 CFR 171-177, 180 – Hazardous Materials Regulations

2. State:
a. Code of Maryland Regulations (COMAR)
1) COMAR 26.13 – Disposal of Controlled Hazardous Substances

1.4 DEFINITIONS

A. Terms defined by EPA Regulation 40 CFR 273 and COMAR Regulation 26.13 have the same meaning when used in this Section.

1.5 SUBMITTALS AND NOTICES

A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer's written approval indicating that the submittal is returned for unrestricted use.
1. Work Plan – The Work Plan shall include but not necessarily be limited to the following:
a. Project contact sheet for key personnel including names, cell phone numbers, and e-mail addresses for:
1) Abatement Contractor

b. Describe work procedures for removal of each type of Universal Waste.

c. List all required personal protective equipment.

d. Describe lockout/tagout procedures.

e. Describe temporary waste storage procedures, including how waste storage containers will be labeled and where they will be stored.

f. Describe transportation and disposal procedures, including the following:
1) Name and address of the waste disposal facility where waste materials are to be recycled/disposed, including copy of license/permit and certificate of insurance
2) Name and address of the transporter who will transport waste materials to the waste disposal facility, including copy of license/permit and certificate of insurance
3) Contractor statement indicating final disposition of Universal Wastes will be recycling

g. Describe spill response procedures, including the following:
1) Personal protective equipment
2) Spill clean-up kits (mercury spill clean-up kit, acid spill clean-up kit, as applicable)
3) Labeling and storage of wastes

4) Transportation and disposal of wastes

2. Liability insurance certificate with the types and amounts of coverage that comply with the requirements outlined in the Contract

B. During work, the Contractor shall submit the following to the Engineer:
1. Copies of all waste manifests on the same day that the waste is picked up

C. Upon completion of work, the Contractor shall submit the following to the Engineer:
1. Final waste disposal manifests signed by the waste disposal/recycling facility

1.6 UNIVERSAL WASTE HEALTH RISKS

A. Where in the performance of the work, the Contractor's workers or supervisory personnel, its Subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified Universal Wastes, take appropriate continuous measures as necessary to protect all building occupants from the risk of exposure to Universal Wastes. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable Federal, State, and Local agencies.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide materials and equipment in quantities necessary to accomplish the work, including but not limited to the following:
1. Disposal bags: 6-mil thick, leak-tight polyethylene bags
2. Small quantity storage containers: five (5) gallons or less capacity for small quantity waste segregation, manufactured with structurally durable materials compatible with the waste type(s)
3. DOT waste disposal drums in accordance with 49 CFR 173

2.2 PERSONAL PROTECTIVE EQUIPMENT

A. As required by OSHA and as applicable to the work hazards encountered, personal protective equipment including but not limited to foot protection, hand protection, head protection, hearing protection, eye and face protection, etc. shall be worn by all site workers.

B. In addition, person(s) conducting the removal of Universal Wastes are required to be aware of the possible health hazards associated with the handling of Universal Wastes and wear appropriate personal protective equipment including but not limited to the following:
1. Chemical resistant eye goggles
2. Disposable coveralls
3. Rubber boot covers or steel-toe rubber boots
4. Chemical resistant gloves (e.g., neoprene, nitrile, etc., as compatible with waste types)

PART 3 - EXECUTION

3.1 UNIVERSAL WASTE TYPE(S) AND ESTIMATED QUANTITIES

Waste Type	Estimated Quantity	Action
2’ Fluorescent Light Tube	1 Each	Remove Affected Items
4’ Fluorescent Light Tube	324 Each	Remove Affected Items
Compact Fluorescent Light Bulb	1 Each	Remove Affected Items
HID Light Bulb	26 Each	Remove Affected Items
Thermostat	2 Each	Remove Affected Items
Battery	11 Each	Remove Affected Items

3.2 METHODS OF COMPLIANCE

A. The Contractor shall adhere to the approved Work Plan.

3.3 PROJECT COMPLETION

A. The Contractor shall remove all equipment, supplies, and waste from the site.

B. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 02 89 00

ABATEMENT MONITORING

PART 1 - GENERAL

1.1 SUMMARY

A. The General Contractor shall retain an independent, third-party Industrial Hygiene Contractor to perform the following:

1. Monitor asbestos abatement and verify that all asbestos-containing materials have been removed prior to work which might disturb those materials.
2. Monitor lead-safe work practices and impact of work to surfaces covered by paint containing lead in any concentration.
3. Monitor universal waste abatement and verify that all universal waste has been removed prior to work which might disturb universal waste.
4. Monitor abatement of sources of polychlorinated biphenyls (PCBs) and verify that all sources of PCBs have been removed prior to work which might disturb sources of PCBs.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Related Sections:

1. Section 02 82 00 – Asbestos Abatement
2. Section 02 83 00 – Impact to Lead Painted Surfaces, Removal and Disposal
3. Section 02 84 00 – Polychlorinated Biphenyl (PCB) Equipment Removal and Disposal
4. Section 02 88 00 – Universal Waste Removal and Disposal

B. Related Documents:

1. Hazardous Materials Survey, Harford Senior Center, 4920 Harford Road, Baltimore, Maryland 21214, dated June 2025, prepared by EA Engineering, Science, and Technology, Inc., PBC

1.3 APPLICABLE STANDARDS AND GUIDELINES

A. Federal, State, and Local health and safety and environmental regulations apply. Failure to cite a regulation herein does not relieve the Contractor or its Subcontractors of the responsibility to comply with that regulation. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or this specification, the more stringent requirements shall be utilized.

B. It shall be the duty and responsibility of the Contractor and its Subcontractors to adhere to all regulations (Federal, State, and Local) impacting this work including but not limited to the following:

1. Federal:
    a. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
        1) 29 CFR 1910 Subpart I – Personal Protective Equipment
        2) 29 CFR 1910.12 – Construction Work
        3) 29 CFR 1910.134 – Respiratory Protection
        4) 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)
        5) 29 CFR 1910.1001 – Asbestos General Industry Standard
        6) 29 CFR 1910.1020 – Access to Employee Exposure and Medical Records

7) 29 CFR 1910.1200 – Hazard Communication
8) 29 CFR 1926 – Safety and Health Regulations for Construction
9) 29 CFR 1926 Subpart AA – Confined Spaces in Construction
10) 29 CFR 1926 Subpart E – Personal Protective and Life Saving Equipment
11) 29 CFR 1926.59 – Hazard Communication
12) 29 CFR 1926.62 – Lead
13) 29 CFR 1926.1101 – Asbestos in Construction

b. U.S. Environmental Protection Agency (EPA)
1) 40 CFR 61, Subpart M – National Emission Standards for Hazardous Air Pollutants (NESHAP), National Emission Standards for Asbestos
2) 40 CFR 117.3 – Determination of Reportable Quantities
3) 40 CFR 260 – Hazardous Waste Management System: General
4) 40 CFR 261 – Identification and Listing of Hazardous Waste
5) 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste
6) 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste
7) 40 CFR 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
8) 40 CFR 268 – Land Disposal Restrictions: General
9) 40 CFR 271 – Requirements For Authorization of State Hazardous Waste Programs
10) 40 CFR 273 – Universal Waste Regulations
11) 40 CFR 302 – Designation, Reportable Quantities, and Notification
12) 40 CFR 761 – Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
13) 40 CFR 763 – Asbestos Hazard Emergency Response Act (AHERA)
14) SW-846 – Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium

c. U.S. Department of Transportation (DOT)
1) 49 CFR 171-177, 180 – Hazardous Materials Regulations

d. National Institute of Occupational Safety and Health (NIOSH)
1) NIOSH Manual of Analytical Methods (NMAM)

2. State:
a. Code of Maryland Regulations (COMAR)
1) COMAR 26.11.21 – Control of Asbestos
2) COMAR 26.11.23 – Asbestos Accreditation of Individuals
3) COMAR 26.13 – Disposal of Controlled Hazardous Substances
4) COMAR 26.16 – Lead

1.4 INDUSTRIAL HYGIENE CONTRACTOR REQUIREMENTS

A. The Industrial Hygiene Contractor shall demonstrate prior experience performing similar monitoring projects. Requirements for prior experience are as follows:
1. Industrial Hygiene Contractor must have a minimum of three years of experience monitoring abatement projects.
2. Industrial Hygiene Contractor must have monitored abatement projects for asbestos, lead, universal waste, and PCBs.
3. Industrial Hygiene Contractor must have monitored abatement on three or more similar types of projects during the past three years.

B. Industrial Hygiene Contractor shall have a written Quality Assurance / Quality Control Program (QA/QC Program) with standard operating procedures for the work of this Section.

The QA/QC Program shall detail procedures for performing all quality control required by the methods selected for sampling and analysis and a means to verify that the quality control procedures are being executed.

C. The Industrial Hygiene Contractor shall have a Certified Industrial Hygienist responsible for quality control on this project. In addition, the Certified Industrial Hygienist will be responsible for approving any revised work procedures and plans developed to address exceedances of Warning and Stop Work Levels described herein.

D. The Industrial Hygiene Contractor shall have an On-site Industrial Hygienist present during all abatement activities. The On-site Industrial Hygienist shall have a minimum of 2 years of experience performing similar monitoring.

E. The On-site Industrial Hygienist shall be accredited by the Maryland Department of the Environment (MDE) as an Asbestos Supervisor and an Asbestos Inspector and shall have training in asbestos monitoring in a course that is equivalent to NIOSH 582.

F. The On-site Industrial Hygienist shall be accredited by the MDE as a Lead Paint Inspector Technician or Risk Assessor.

1.5 DEFINITIONS

A. Industrial Hygiene Contractor – Independent, third-party industrial hygiene consulting firm retained by the Contractor to perform the duties described in this Section

B. Certified Industrial Hygienist – A person certified by the Board for Global EHS Credentialing in the comprehensive practice of industrial hygiene

C. On-site Industrial Hygienist – The representative of the Industrial Hygiene Contractor who is on-site daily and has the primary responsibility for executing the work of this Section

D. Stop Work Level – The level of airborne contaminant at which all work must stop, and a plan developed to address the exceedance

E. Warning Level – The level of airborne contaminant at which the abatement contractor shall revise work procedures to reduce the level of contaminant

1.6 SUBMITTALS AND NOTICES

A. Prior to commencement of work, submit to the Engineer the items listed as follows for review. Work shall not start until these submittals are returned with the Engineer's written approval indicating that the submittal is returned for unrestricted use.

1. A statement of qualification providing evidence that the Industrial Hygiene Contractor has the experience required by Paragraph 1.4A of this Section. The statement shall include a point of contact, phone number, and e-mail address for each project referenced.
2. A list including the names, cell phone numbers, and e-mail addresses for the Certified Industrial Hygienist and On-site Industrial Hygienist. For each individual, submit resumes, non-expired certificates of training, non-expired MDE recognized accreditations, non-expired medical approval to wear a respirator, and current fit test for respirator.
3. The Industrial Hygiene Contractor's written QA/QC Program with a statement signed and sealed by the Certified Industrial Hygienist that the QA/QC Program has been reviewed and includes procedures for performing all quality control required by the methods selected for sampling and analysis and a means to verify that the quality control procedures are being executed.

4. Certification signed by an officer of the Industrial Hygiene Contractor that the respiratory protection program is being kept in conformance with 29 CFR 1910.134.

B. During abatement activities, the Industrial Hygiene Contractor shall:
   1. Immediately notify the General Contractor and Engineer by telephone with a follow-up e-mail if any of the following conditions occur:
      a. Breach of containment

      b. Applicable Stop Work Level is exceeded for contaminants in air

      c. Accident resulting in personal injury requiring medical attention

      d. Property damage of over $500.00

C. Upon completion of work, the General Contractor/Industrial Hygiene Contractor shall submit the following to the Engineer:
   1. Compiled sets of daily job progress logs
   2. Completed containment inspection check lists
   3. Completed final clearance check lists for days when a final clearance inspection is performed
   4. Compiled set of air monitoring data/records
   5. Analytical report for all samples analyzed on-site and all certificates of analysis for samples analyzed at a contract laboratory
   6. Spreadsheet recording information on waste shipments including date, type and quantity of material shipped, and waste manifest number
   7. Incident investigation reports
   8. A statement issued by the Industrial Hygiene Contractor that all hazardous materials included in the specifications have been removed, that wall penetrations and pipe chases have been inspected using destructive techniques and all asbestos in these locations has been removed, and the Industrial Hygiene Contractor is not aware of any hazardous materials remaining in the work area(s) with the exception of lead-containing paint that will be left in place during abatement

1.7 WARNING LEVELS AND STOP WORK LEVELS

A. Inside Work Area (Area and Personal Monitoring):
   1. The Warning Level for any sample taken shall be 25% of the Maximum Use Concentration as defined by OSHA in 29 CFR 1910.134. If airborne concentrations for any one sample exceed the Warning Level, the abatement contractor shall revise work procedures to lower airborne contaminant levels.
   2. The Stop Work Level shall be 50% of the Maximum Use Concentration (as defined by OSHA in 29 CFR 1910.134) for any one sample or 25% of the Maximum Use Concentration for the Time Weighted Average (TWA) of any work shift or 8-hour period. Work shall be stopped and a plan developed to address the exceedance. The plan must be approved by the Certified Industrial Hygienist. Do not recommence work until authorized in writing by the Certified Industrial Hygienist and the Engineer.

B. Outside Work Area:
   1. The Stop Work Level shall be 50% of the Permissible Exposure Limit for the applicable contaminant, with the exception of asbestos. The Stop Work Level for asbestos shall be 10% of the Permissible Exposure Limit or the background level, whichever is greater. If airborne concentrations for any one sample exceed this Stop Work Level, work shall be stopped and a plan developed to address the exceedance. The plan must be approved by the Certified Industrial Hygienist. Do not recommence

work until authorized in writing by the Certified Industrial Hygienist and the Engineer. If the exceedance was the result of a failure of work area isolation measures, initiate the following actions:

a. Immediately stop all abatement work.

b. Contact project Certified Industrial Hygienist for direction.

c. Notify the Engineer.

d. Evaluate possible sources of contamination.

e. Repair damaged containment.

f. As directed by the project Certified Industrial Hygienist, decontaminate surfaces outside of the containment that may have been contaminated.

g. Collect an outside sample(s).

h. If the outside sample(s) passes, re-start abatement. If the outside sample(s) fails, repeat steps d. through g.

1.8 AUTHORITY TO STOP WORK

A. The Owner's Representative, Industrial Hygiene Contractor, or the Engineer have the authority to issue a work stoppage at any time during the abatement work if the Owner's Representative, Industrial Hygiene Contractor, or Engineer deems that conditions are in violation of these specifications or any Federal, State, or Local regulations.

B. Delays, stand-by time, and expenses necessary for the General Contractor to take corrective action, resolve any violations of these specifications or applicable laws shall be at the General Contractor's expense.

PART 2 - PRODUCTS

2.1 SAMPLING

A. Flow Measurement Devices shall have had the flow rate checked within the past 3 months and at least every 3 months during the project against a primary standard that is traceable to a standard at the National Institute of Standards and Technology (NIST).

B. Pumps shall be capable of maintaining the required flow rate +/- 10% for the duration of the sampling period.

C. Asbestos Cassettes

1. Phase Contrast Microscopy (PCM) cassettes shall be 25 mm cassettes with 0.8 micron Mixed Cellulose Ester (MCE) membrane filters.
2. Transmission Electron Microscopy (TEM) cassettes shall be 25 mm cassettes with 0.45 micron MCE membrane filters.

D. Lead cassettes shall be 37 mm cassettes with 0.8 micron MCE membrane filters.

2.2 DIRECT READING METERS

A. Direct reading meters shall have been calibrated as recommended by the manufacturer.

B. Daily Check:
   1. An X-Ray Fluorescence (XRF) analyzer shall have the calibration verified with calibration readings every 4 hours.
   2. Other meters shall be field checked, if recommended by the manufacturer.

2.3 PCM ANALYSIS ON SITE

A. Microscope shall be equipped with a phase contrast diaphragm, a Walton-Becket graticule, and a telescope ocular.

B. An HSE/NPL slide shall be available for regular checking of the resolution of the scope.

C. An acetone vaporizer or acceptable substitute shall be used to dissolve filter membrane.

D. Blind quality control slides shall be included for analysis each day.

2.4 PERSONAL PROTECTIVE EQUIPMENT

A. As required by OSHA and as applicable to the work hazards encountered, personal protective equipment including but not limited to foot protection, hand protection, head protection, hearing protection, eye and face protection, etc. shall be worn.

B. In addition, Industrial Hygiene Contractor shall wear task-specific personal protective equipment, if entering work area(s), including but not limited to:
   1. Chemical resistant eye goggles
   2. Disposable coveralls and hand, head and foot covers
   3. Rubber boot covers or steel-toe rubber boots
   4. Chemical resistant gloves (e.g., neoprene, nitrile, etc., as compatible with waste types)
   5. Respiratory protection (refer to 2.5 as follows)

2.5 RESPIRATORY PROTECTION

A. Respirators are required to be worn by employees of the Industrial Hygiene Contractor when entering work areas involving disturbance to asbestos-containing materials and lead in paint.

B. The Industrial Hygiene Contractor’s respiratory protection program shall be in compliance with 29 CFR 1910.134.

PART 3 - EXECUTION

3.1 HAZARDOUS MATERIALS INSPECTIONS

A. Industrial Hygiene Contractor shall be familiar with the hazardous materials identified within the previously referenced Hazardous Materials Survey and the project specifications.

B. Industrial Hygiene Contractor shall be responsible for verifying that all materials identified in the project specifications to be affected by the planned work are abated.

C. Industrial Hygiene Contractor shall be responsible for identifying suspect hazardous materials not reported in the project specifications. Areas of particular importance are through wall penetrations, pipe chases behind walls, and electrical cabinets. Inclusion of the collection and laboratory analysis of 25 bulk samples for asbestos shall be required. A spreadsheet shall be developed that reports all suspect hazardous materials identified, results of sampling, and removal date.

D. At the conclusion of the abatement, the Industrial Hygiene Contractor shall issue a statement that all hazardous materials included in the specifications have been removed, that wall penetrations and pipe chases have been inspected using destructive techniques and all asbestos in these locations has been removed, and that Industrial Hygiene Contractor is not aware of any hazardous materials remaining in the building with the exception of lead-containing paint that will be left in place during abatement.

3.2 WORK PRACTICE INSPECTIONS

A. Asbestos:

The On-site Industrial Hygienist shall be on-site during all asbestos abatement activities and perform the following duties:

1. Review the Work Plan submitted by General Contractor/Abatement Contractor and approved by the Engineer.
2. Report any observations of failure of the Abatement Contractor to comply with the accepted Work Plan or any Federal or State regulations to the supervisor of the Abatement Contractor. If they are not immediately corrected, report the observation to the General Contractor and to the Engineer with a recommendation that a stop work order be issued.
3. Issue a stop work order whenever asbestos concentrations in air exceed a Stop Work Level or whenever there is an immediate threat to the health or safety of a worker, the public, or the environment.
4. Verify that each asbestos worker and asbestos supervisor has a valid asbestos photo identification card with them each day that asbestos abatement is performed. Maintain a checklist of workers present each day with a mark indicating that their card was verified that day.
5. Complete a pre-abatement checklist for each containment indicating that all required elements are appropriately installed.
6. Work Area Monitoring
   a. Continuous air monitoring of the interior work area and outside work area is required when a negative pressure enclosure is utilized.

   b. Continuous air monitoring of the work area is required when a negative air pressure enclosure is not utilized and the work is performed indoors.

   c. Samples shall be analyzed on-site and a file with all results shall be maintained on-site.
7. Complete a daily checklist for each containment indicating that all required elements are appropriately installed. This checklist shall include verifying negative pressure at a minimum of every two (2) hours during the day.
8. Maintain a daily log of the Abatement Contractor's activities. A log of the On-site Industrial Hygienist's activities is not required. The log must include the following:
   a. Start and stop time

   b. Number of abatement workers and supervisors on-site

   c. A separate section for each containment in progress with a description of work accomplished that day

   d. A report on any incidents including but not limited to, loss of power, breach of containment, accidents, and visits by MDE, MOSH, or OSHA inspector

   e. A section for waste removal indicating quantity of waste removed and waste shipping record number
9. Perform final clearance air sampling as required by COMAR 26.11.21.

10. Complete a post-abatement checklist to include visual inspection, verification of encapsulation, and whether final clearance samples pass or fail.
11. Verify that all wastes associated with the abatement of asbestos have been removed.

B. Impact to Lead-Containing Painted Surfaces:
1. Review the Lead Compliance Program and Lead Waste Management Plan submitted by the General Contractor/Abatement Contractor and approved by the Engineer.
2. Report any observations of failure to comply with the accepted Lead Compliance Program and Lead Waste Management Plan or any federal or state regulations to the supervisor of the Abatement Contractor. If they are not immediately corrected, report the observation to the General Contractor and to the Engineer with a recommendation that a stop work order be issued.
3. Issue a stop work order whenever lead concentrations in air exceed a Stop Work Level or whenever there is an immediate threat to the health or safety of a worker, the public, or the environment.
4. Inspect the Abatement Contractor work practices for conformance with project specification and Federal and State regulations.
5. Maintain a record of hazardous waste shipments including date shipped, quantity shipped, and shipping record number.

C. Universal Waste and PCBs:
1. Review the Work Plans submitted by the General Contractor/Abatement Contractor and approved by the Engineer.
2. Verify that workers have received training in the hazards associated with the wastes.
3. Report any observations of failure of abatement contractor to comply with the submitted Work Plans or any Federal or State regulations to the supervisor of the Abatement Contractor. If they are not immediately corrected, report the observation to the General Contractor and to the Engineer with a recommendation that a stop work order be issued.
4. Maintain a record of waste shipments including date shipped, quantity shipped, and shipping record number.
5. Verify that all wastes have been removed.

3.3 WORKER EXPOSURE MONITORING

A. Asbestos:
1. Collect daily exposure monitoring samples representative of the worker exposure for each class of worker performing Class I or Class II asbestos work.
2. Record all information required by 29 CFR 1926.1101 (n)(2).
3. Post results at the site as soon as practical but at the latest 24 hours after receipt of results.

B. Lead:
1. Perform an initial exposure assessment for each task being performed.
2. If applicable to duration of project, repeat exposure assessment at a minimum of once every three months.
3. Record all information required by 29 CFR 1926.62 (n)(1).
4. Post results at the site as soon as practical but at the latest 24 hours after receipt of results.

3.4 AREA MONITORING TO EVALUATE CONTAINMENT EFFECTIVENESS

A. During asbestos abatement collect area samples from inside of the containment, within the decontamination zone (near the exit), outside of the exit from a bagout (if used), and at the exhaust from the negative air machine if accessible. The target volume for samples inside

of the containment is 120 liters. The target volume for samples outside of the containment is 1,200 liters. If the level of dust results in overloaded samples at these volumes, the target volume shall be decreased to a volume resulting in a dust loading that can be analyzed. Samples shall be analyzed on-site and a file with all results shall be maintained on-site.

3.5 PROJECT COMPLETION

A. The project will be considered complete when all required submittals have been received and approved.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Concrete toppings.
   5. Masonry walls.

B. Related Sections:
   1. Section 031200 "Earthwork" for drainage fill under slabs-on-grade.
   2. Section 016000 “Product Requirements” for Concrete cement and aggregate must be extracted, processed and manufactured at a facility within 500 miles of the project site.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete mixture. Include alternate mix when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.

4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates.

G. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
1. Floor slabs shall be finished to a minimum flatness F-number Ff=30 and a minimum levelness F-number Fl=25 in any direction (U.N.O.).
2. Exterior concrete stairs shall have the treads and landings sloped approximately 1/8” per 12” to assure that no water rests on a riser or the landing.

H. Field quality-control reports.
1. Submit results of compression cylinders and grout cubes.
2. Test Reports: Including strength and density of furnished product.
3. Inspection reports: certifying rebar and welded wire fabric placement, etc.

I. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 301, "Specification for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Avoid damaging coatings on steel reinforcement.
   2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

B. Reinforcing Bars: ASTM A 615/, Grade 60, deformed.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II supplement with the following which shall have 25% by weight of the total cementitious material:
      a. Fly Ash: ASTM C 618, Class F or C.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
   1. Class: Moderate weathering region, but not less than 3M.
   2. Nominal Maximum Aggregate Size: 3/4 inch.
   3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.

C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

H. Products: Subject to compliance with requirements, provide one of the following:
   1. Evaporation Retarder:
      a. Cimfilm; Axim Concrete Technologies.
      b. Finishing Aid Concentrate; Burke Group, LLC (The).
      c. Spray-Film; ChemMasters.
      d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
      e. Sure Film; Dayton Superior Corporation.
      f. Eucobar; Euclid Chemical Co.
      g. Vapor Aid; Kaufman Products, Inc.
      h. Lambco Skin; Lambert Corporation.
      i. E-Con; L&M Construction Chemicals, Inc.
      j. Confilm; Master Builders, Inc.
      k. Waterhold; Metalcrete Industries.
      l. Rich Film; Richmond Screw Anchor Co.
      m. SikaFilm; Sika Corporation.
      n. Finishing Aid; Symons Corporation.
      o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
   2. Clear, Waterborne, Membrane-Forming Curing Compound:
      a. AH Clear Cure WB; Anti-Hydro International, Inc.
      b. Spartan Cote WB; Burke Group, LLC (The).
      c. Safe-Cure & Seal 20; ChemMasters.
      d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
      e. Safe Cure and Seal; Dayton Superior Corporation.
      f. Diamond Clear VOX; Euclid Chemical Co.
      g. SureCure; Kaufman Products Inc.
      h. Glazecote Sealer-20; Lambert Corporation.
      i. Dress & Seal WB; L&M Construction Chemicals, Inc.
      j. Vocomp-20; W. R. Meadows, Inc.
      k. Metcure; Metalcrete Industries.
      l. Cure & Seal 100E; Nox-Crete Products Group, Kinsman Corporation.
      m. Rich Seal 14 percent E; Richmond Screw Anchor Co.

n. Kure-N-Seal W; Sonneborn, Div. of ChemRex, Inc.
o. Florseal W.B.; Sternson Group.
p. Cure & Seal 14 percent; Symons Corporation.
q. Horncure 100; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
r. Hydroseal; Unitex.
s. Vexcon Starseal 309; Vexcon Chemicals, Inc.

3. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
   a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
   b. Polyseal WB; ChemMasters.
   c. UV Safe Seal; Lambert Corporation.
   d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
   e. Vocomp-30; W. R. Meadows, Inc.
   f. Metcure 30; Metalcrete Industries.
   g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

2.7 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
   1. Type: Class II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
   2. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   3. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Reglets: Fabricate reglets of not less than 0.0217-inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
   1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Slabs-on-Grade, Piers, Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
   3. Maximum Water-Cementitious Materials Ratio: 0.50 maximum.
   4. Slump Limit: 4 inches plus or minus 1 inch.
   5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

B. Exterior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3500 psi at 28 days.
   2. Minimum Cementitious Materials Content: 517 lb/cu. yd.
   3. Maximum Water-Cementitious Materials Ratio: 0.45 maximum.
   4. Slump Limit: 4 inches plus or minus 1 inch.
   5. Air Content: Used in concrete exposed to weather. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 7.0 percent, unless otherwise indicated.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class C, 1/2 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
   1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Do not chamfer corners or edges of concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.

2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
1. 28-day design compressive strength.
2. At least 70 percent of 28-day design compressive strength.
3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
   1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
   2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
a. Water.
b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
    a. Test two field-cured specimens at 7 days and two at 28 days.
    b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

D. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

E. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

F. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency

may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION

SECTION 03 54 17

CEMENTITIOUS FLOOR UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section stipulates requirements for Self-Leveling Underlayment Concrete for use over specified interior substrates.

1.2 REFERENCES

A. American Society of Testing Materials (ASTM) C472-79

1.3 QUALITY ASSURANCE

A. Installation of underlayment must be by an applicator using mixing equipment and tools approved by the manufacturer.

B. Underlayment to be applied to a minimum thickness of 1/8” over highest point in the subfloor, with an average typical thickness of ¼”.

C. Underlayment compressive strength shall be 4100 psi after 28 days per ASTM C109/mod (air cure only).

D. Underlayment shall be walkable after 2 hours and allow floor covering to be installed after 16 hours at 70˚ F.

E. Manufacturer’s certification that the product is Portland cement-based having an inorganic binder content which is a minimum 80% Portland cement when tested per ASTM C150: Standard Specification for Portland Cement.

1.4 SUBMITTALS

A. Product Data:
   1. Materials list of products to be installed under this Section.
   2. Manufacturer's specifications and other data required to establish compliance with requirements of this Section.
   3. Manufacturer's installation instructions.
   4. Manufacturer's field inspection and field testing procedures.
   5. Underlayment manufacturer's preparation instructions for attaching finished floor goods.
   6. Underlayment manufacturer's list of approved preparation materials for attaching finished floor goods.

1.6 DELIVERY, STORGAE AND HANDLING

A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

1.7 SITE CONDITIONS

A. Observe the basic rules of concrete work. Maintain temperature above 50 degrees F. before, during, and after application of underlayment. Provide continuous ventilation and adequate heat to dry underlayment in 5-7 days. Install quickly if floor is warm and follow hot weather precautions available from the ARDEX Technical Service Department. Never mix with cement or additives other than ARDEX-approved products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The cement-based self-leveling underlayment shall be ARDEX K-15 Self-Leveling Underlayment Concrete.

B. Primer for standard absorbent concrete shall be ARDEX P-51 Primer.

C. Water shall be clean, potable, and sufficiently cool (not warmer than 70˚ F).

2.2 MIX DESIGNS

A. Standard mixing ratio: ARDEX K-15 is mixed in 2-bag batches at one time. Mix each bag of ARDEX K-15 (55 lb.) with 7 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a ½" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX K-15 bag label.

PART 3 - EXECUTION

3.1 PREPARATION AND EXAMINATION

A. All subfloors must be sound, solid, cleaned, and primed:
   1. All concrete subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bondbreaker before priming. Mechanically clean if necessary using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.
   2. Cutback and other non-water soluble adhesive residues must be wet scraped to a thin, well-bonded layer.
   3. Non-porous subfloors such as ceramic and quarry tile as well as terrazzo should be clean and free of all waxes and sealers. If necessary, have the surface professionally cleaned.
   4. All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.
   5. Substrates shall be inspected and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering.

B. Joint Preparation
   1. Moving Joints – extend all expansion and isolation joints up through the underlayment.
   2. Saw Cuts and Control Joints – fill all non-moving joints with ARDEX SD-F Feather Finish or ARDEX SD-P Instant Patch as required.

C. Priming
   1. Primer for standard absorbent concrete subfloors: Mix ARDEX P-51 1:1with water and apply evenly with a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until the primer is dry. Primer coverage is approximately 400 to 600 sq. ft. per gallon.
   2. Primer for extremely absorbent concrete subfloors: Make an initial application of ARDEX P-51 mixed with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry thoroughly before proceeding with the standard application of primer as described above for standard absorbent concrete.
   3. Primer for non-porous subfloors, wooden or metal subfloors, or cutback and other non-

water soluble adhesive residues over concrete: Prime with ARDEX P-82 Ultra Prime. Mix Part A (red) with Part B (white) and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tack film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Primer coverage is approximately 200 to 400 square feet per gallon.

4. Minimum drying time for ARDEX P-82 Ultra-Prime over cutback adhesive is 18 hours.

3.2 APPLICATION OF UNDERLAYMENT

A. Installation: Pour or pump the liquid ARDEX K-15 and spread in place with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball shoes with non-metallic cleats to avid leaving marks in the liquid ARDEX K-15. Underlayment can be walked on in 2-3 hours at 70˚ F.

3.3 PREPARATION FOR FLOORING INSTALLATION

A. Underlayment can accept finish floor covering materials after 16 hours at 70˚ F and 50% relative humidity.

B. Due to the wide range of adhesives that are used to install floor coverings, some adhesives may dry more quickly over ARDEX underlayments than over other substrates. If this condition occurs, priming the surface of the underlayment with ARDEX P-51 Primer diluted 1:3 with water will even out the drying of the adhesive. Allow the primer to dry 1-3 hours before proceeding with the adhesive installation.

3.4 FIELD QUALITY CONTROL

A. Where specified field sampling of the ARDEX underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

B. Submit final satisfactory test results to Architect prior to installation of any finish floor goods.

3.5 DRYING AND REPAIR

A. Check for dryness by taping a 24 inch by 24 inch section of plastic to surface of underlayment. Underlayment is considered dry when no condensation occurs in 48 to 72 hours.

B. Inspect for rough or chalky spots. Repair those spots by back-troweling or by using a hand stone. Scrape loose all chalky material. Remove by sweeping or vacuuming area.

C. Repair gouges and nicks with primer and topping mixture in accordance with underlayment manufacturer's instructions.

3.6 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by others trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Concrete masonry, and masonry accessories. The term “Concrete Masonry Unit” is abbreviated as “CMU” throughout this specification.

1.2 QUALITY ASSURANCE

A. Fire Performance Characteristics:
Where fire resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

1.3 SUBMITTALS

A. Product data:
1. Materials list of items proposed to be provided under this Section
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements. Provide shop drawings for special shapes.

B. Samples:
1. Exposed exterior masonry units
2. Mortar colors for selection by Architect

1.4 PRODUCT HANDLING

A. Store masonry and brick units on pallets and covered with impervious tarpaulins.

1.5 JOB CONDITIONS

A. Protection of Work:
1. During erection, cover top of walls with waterproof sheeting at the end of each days' work. Cover partially completed structures when work is not in progress.
2. Extend the cover a minimum of 2 feet down both sides and hold cover securely in place.
3. Do not apply uniform floor or roof loading for at least 24 hours after building masonry walls or columns.
4. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

B. Staining:
1. Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of walls from rain splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
2. Protect sills, ledges and projections from droppings of mortar.

C. Cold Weather Protection:
1. Do not lay masonry units that are wet or frozen.
2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
3. Remove all masonry determined by the Architect to be damaged by freezing conditions.
4. For clay masonry units with initial rates of absorption which require them to be wetted before laying, comply the following requirements:

5. For units with surface temperatures above 32 degrees F, wet with water heated to above 70 degrees F.
6. For units with surface temperatures below 32 degrees F, wet with water heated to above 130 degrees F.
7. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at the time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 degrees F.
    a. 40 degrees F to 32 degrees F:
        i. Mortar: Heat mixing water to produce mortar temperature between 40 and 120 degrees F.
        ii. Grout: Follow normal masonry procedures.
    b. 32 degrees F to 25 degrees F:
        i. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 degrees F. Maintain temperature of mortar on boards above freezing.
        ii. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at the end of the work day.
    c. 25 degrees F to 20 degrees F:
        i. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 degrees F. Maintain temperature of mortar on boards above freezing.
        ii. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at the end of the work day.
        iii. Heat both sides of walls under construction using salamanders or other heat sources.
        iv. Use windbreaks or enclosures when wind is in excess of 15 miles per hour.
    d. 20 degrees F and below:
        i. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 degrees F.
        ii. Grout: Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at the end of each work day.
        iii. Masonry Units: Heat masonry units so that they are above 20 degrees F at the time of laying.
        iv. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F for 24 hours after laying units.
        v. Do not heat water for mortar and grout to above 160 degrees F.
        vi. Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry temperature ranges apply to anticipated minimum night temperatures.
    e. 40 degrees F to 32 degrees F:
        i. Protect masonry from rain or snow for at least 24 hours by covering with weather resistive membrane.
    f. 32 degrees F to 20 degrees F:
        i. Completely cover masonry with weather resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
    g. 20 degrees F and below:
        i. Except as otherwise indicated, maintain masonry temperature above 32 degrees F for 24 hours using enclosures and supplementary heat, electric blankets, infrared lamps or other methods proven to be satis-factory. For grouted masonry maintain heated enclosure to 40 degrees F for 48 hours.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Gravel or stone units with face dimensions of 8” high x 16” long, nominal, and thickness as shown and noted on the drawings. CMU noted as solid on the drawings shall have no voids or cores; filled cores are not acceptable as a substitution for “Solid CMU”. Provide CMU complying with the following:
   1. Hollow Load bearing CMU: ASTM C-90, Grade N, Type I
   2. Solid Load bearing CMU: ASTM C-145, Grade N, Type I
   3. Hollow Non-Load bearing CMU: ASTM C-129, Type I, normal weight
   4. CMU Brick: ASTM C55, Grade N, Type I

B. Curing: Cure units in a moisture controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C-90 Type I, C-129 Type I, C-145 Type I, and C-155 Type I.

C. Limit moisture absorption during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest the project site.

D. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

2.2 MORTAR MATERIALS

A. Masonry Cement: ASTM C91 Masonry Cement
   1. Provide colored pigmented mortars for all exterior exposed masonry work. Use premixed colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Use natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.
   2. Color shall be selected by Architect from manufacturer’s full range of standard colors.
   3. Classification of Masonry Cement:
      a. Brick Masonry Walls: Type N
      b. CMU Walls: Type S

B. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

C. Aggregate for Grout: ASTM C 404.

D. Water: Clean and Potable.

2.3 MASONRY ACCESSORIES

A. Horizontal Joint Reinforcing: Provide welded wire units prefabricated in straight lengths of not less than 10' with matching corner ("L") and intersecting ("T") units. Fabricate from cold drawn steel wire complying with ASTM A 82, into units with widths of approximately 2" less than nominal width of walls and partitions as required to position side rods for full embedment in mortar with mortar coverage of not less than 5/8" on joint faces exposed to exterior and not less than 1/2" elsewhere. Provide the following type of joint reinforcing unless otherwise indicated.

B. Wire Finish: Hot dipped galvanized after fabrication in accordance with ASTM – B153.

C. Single Wythe Concrete Masonry Unit Walls and Foundations:
Truss Type: Double side rod joint reinforcing with diagonal cross rods spaced not more than 16" on center made of 9-gage cross and side rods.

D. Individual Wire Ties for Masonry:
General: Fabricate from 3/16" cold drawn steel wire, ASTM A 82, unless otherwise indicated, of the length required for proper embedment in wythes of masonry. Fabricate from steel with 1.5 ounce hot dip zinc coating, ASTM A 153 class B-2, or fabricate steel wire with not less than 7-mil copper coating, ASTM B 227, Grade 30 HS.

E. Flashings for Masonry:
Provide concealed flashings as follows: Preformed 0.015" thick stainless steel through wall flashing made from ASTM 167A, type 304 stainless with no. 2D annealed finish, dead soft temper. Flashings shall be "3-Way" factory preformed units formed to provide a bond in the mortar in both vertical and horizontal directions. Form material with 3/16" high raised saw tooth ribs spaced 3 inches on center throughout the length of the flashing. At face of raised sawtooth portion provide indented keys for transverse bond. Lap joints shall be formed for interlocking to produce a total 1-1/2" interlock. Flashing shall be factory formed in widths required for wall thickness. Provide factory formed corners, shaped and soldered to fit job conditions. Fasteners shall be stainless steel. Solder shall be ASTM B32, 50% tin and 50% lead, used with a phosphoric acid flux.

F. Miscellaneous Masonry Accessories:
Non-Metallic Expansion Joint Strips: Provide premolded, compressible, elastic fillers of foam rubber, neoprene, or extruded plastic.

2.5 MORTAR AND GROUT MIXES

A. General: Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.
1. CMU Walls: Type S

C. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and non-reinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.
1. Admixes: No admixes will be permitted except where specified or without written authorization of Architect. No calcium chloride in any form will be permitted.

PART 3 – EXECUTION

3.1 INSTALLATION; GENERAL

A. Thickness:
1. Build masonry construction to the full thickness shown, except, build single-wythe wall (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
2. Cut masonry units with motor-driven saw designed to cut masonry with a clean, sharp, unchipped edge. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Use dry cutting saws to cut concrete masonry units.

B. Wetting: Do not wet concrete masonry units.

C. Pattern Bond:
1. Lay exposed masonry in the bond pattern to match adjacent construction. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2". Bond and interlock each course of each wythe at the corners, unless otherwise shown.

2. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.
3. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.

D. Stopping and Resuming Work: Rack back 1/2 masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

3.4 MORTAR BEDDING AND JOINTING

A. Lay brick and solid concrete masonry units with completely filled bed, head and collar joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.

C. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. Tool exposed joints slightly concave using a jointer larger than joint thickness. Rake out mortar in preparation for application of caulking or sealants where shown.

D. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

E. Fill joints between wythes solidly with mortar. Fill collar joints after each course is laid.

3.5 HORIZONTAL JOINT REINFORCING

A. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcement a minimum of 6". Do not bridge control and expansion joints with reinforcing, unless otherwise indicated. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by the manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

B. Space continuous horizontal reinforcing 16" on center vertically.

C. For parapets, space reinforcing at 8" on center vertically, unless otherwise indicated.

D. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in horizontal joints approximately 8" apart, both immediately above lintels and below sills. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

3.6 ANCHORING MASONRY WORK

A. Provide anchoring devices of the type indicated. If not indicated, provide standard type for facing and back-up involved.

B. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
   1. Provide an open space not less than 1" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
   2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise indicated.
   3. Space anchors as shown, but not more than 24" on center vertically and 36" horizontally.

3.7 LINTELS

A. Steel Lintels: Install loose lintels of steel and other materials as shown on the drawings. Provide a minimum bearing of 8" at each jamb, unless otherwise indicated.

B. Masonry Lintels:
   1. Provide masonry lintels where shown and wherever openings of more 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed in place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed in place lintels for minimum 48 hours.

   2. For hollow concrete masonry unit walls, use specially formed "U" shaped lintel units with reinforcing bars placed as shown and filled with grout of consistency required to completely fill space between reinforcing bars and masonry unit.

3.8 CONTROL AND EXPANSION JOINTS

A. Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related masonry accessory items as the masonry work progresses.

B. Build flanges of metal expansion strips into masonry. Lap each joint 4" in direction of flow. Seal joints below grade and junctures with horizontal expansion joints, if any.

3.9 FLASHING OF MASONRY WORK

A. Protection of Flashing Material: Contractor shall protect stainless steel flashing material from exposure to chlorides and muriatic acids at all times. Separate stainless steel from other metals while stored.

B. Flashing Installation:
Comply with manufacturer's written instructions.
   1. Provide concealed flashings in masonry work at, or above, all floor levels, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar.
   2. Extend flashings the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from a line 1/2" in from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", but not less than shown on the drawings, and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior backup construction is framed walls or stud framing, turn flashing minimum 8" up the face of the wall and attach flashing minimum 16" on center using stainless steel screws. Interlock end joints of flashing by overlapping performed keys not less than 1-1/2". At heads and sills turn up ends not less than 2" to form a pan. Use only factory fabricated inside and outside mitered corners.

C. Weepholes: Provide weepholes in the head joints of the same course of masonry bedded in the flashing mortar. Construct weepholes such that the flashing is placed at the bottom

of the weephole. **KEEP WEEPHOLES FREE AND CLEAR OF MORTAR AT ALL TIMES DOWN TO THE LEVEL OF THE FLASHING.** Insert pre-formed, cellular weep units with no mortar in the joint

3.10 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed brick masonry surfaces by the bucket and brush hand cleaning method. Comply with the requirements of the Brick Institute Technical Notes No. 20 "Cleaning Brick Masonry". Do not use acid cleaning agents.

D. Post-Construction: Clean a 10 sq. ft. area of wall as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:
   1. Protect windows, sills, doors, trim and other work from damage.
   2. Remove large particles with [stiff fiber brushes] [wood paddles] without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
   3. Scrub with solution of 1 tsp. trisodium phosphate and 1 tsp. household detergent dissolved in 4 cups of clean water using stiff fiber brushes, then clean off immediately with clean water using hose.
   4. Repeat cleaning process as often as necessary to remove mortar and other stains.

E. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

F. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA Technical Bulletin No. 28.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Architecturally exposed structural steel.
   3. Grout.

B. Related Sections:
   1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction".
   2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Combined system of moment frame, braced frame, and shear walls.

C. Moment Connections: Type FR, fully restrained.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Shear stud connectors.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M, Grade 50.

B. Channels, Angles: ASTM A 36.

C. Plate and Bar: ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
1. Weight Class: Standard.
2. Finish: Black**.**

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
1. Finish: Plain**.**

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
1. Configuration: as indicated.
2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
1. Nuts: ASTM A 563 hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   1. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
   2. Mark and match-mark materials for field assembly.
   3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
   2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.
   3. All structural steel, bolts, connectors and fasteners exposed to moisture shall be galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base, Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened (U.N.O.).

B. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect the erected steel in the field. This inspection shall also include alignment, position of member, welds and high-strength bolted connections, painting, etc. The inspection agency shall also submit to the Structural Engineer certified reports showing results of these inspections.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. Should deficiencies in welds be noted by visual inspection then field welds may be tested according to AWS D1.1 and the following inspection procedures, at Owner's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

   2. In addition to the visual inspection as indicated above, ultrasonic testing of all groove welds which are in tension and 25% of all groove welds which are in compression shall be required. The testing shall be done using "Branson" ultrasonic testing equipment, or other approved non-destructive testing systems. If faulty welds are discovered by this testing, costs of repair and any additional tests shall be borne by the Contractor.

D. Should visual inspection identify deficiencies in welded shear connectors, then field-welded shear connectors may be tested according to requirements in AWS D1.1 for stud welding at Owner’s option as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

F. Submit certified field reports, indicating that the steel, including corrected deficiencies as erected meets all of the requirements of the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and

accessories**,** bearing plates, and abutting structural steel where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099100 “Painting."

END OF SECTION

SECTION 05 40 00

COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.
   2. Interior non-load-bearing wall framing.
   3. Soffit framing.

B. Related Requirements:
   1. Section 05500 "Metal Fabrications" for masonry shelf angles and connections.
   2. Section 09111 "Non-Load-Bearing Steel Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Delegated-Design Submittal: For cold-formed steel framing.

C. Shop Drawings: Submit placement drawings for framing members showing size and gage designations, number, type, locations, and spacing. Indicate reinforced channels, opening framing, supplemental strapping, bracing, bridging, splices, connection details, accessories and details required for proper installation. Shop Drawings shall be signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by the lightgauge metal framing contractor.
   1. Include fully dimensioned and detailed drawings of special components not covered by Product Data.
   2. Submittal to include complete design calculations signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by the lightgauge metal framing contractor.

D. Stud sizes and details shown on Drawings indicate general installation and connection methods. Complete design and detailing of all components for all loads and forces is to be shown on the Shop Drawings. Design of all conditions not detailed on the Drawings shall be provided by a registered Professional Engineer, licensed in the State in which project is located and employed by the lightgauge metal framing contractor. No changes from sizes and installation methods shown will be permitted without the express written consent of the Architect and the Structural Engineer.

E. Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

F. Welding certificates.

G. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

H. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, connection design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. Dale/Incor.
2. Dietrich Metal Framing; a Worthington Industries Company.

3. MarinoWare; a division of Ware Industries.

2.02 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: ST33H.
   2. Coating: G60.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: 50.
   2. Coating: G90

C. Steel studs 18 gauge and lighter components: Fabricate components of commercial quality steel sheet (ASTM A446 for galvanized finish) with a minimum yield point of 33,000 psi.

D. Steel studs 16 gauge and heavier components: Fabricate components of structural quality steel sheet (ASTM A446 for galvanized finish) with a minimum yield point of 50,000 psi.

E. Track and bridging components: Fabricate components of commercial quality steel sheet (ASTM A446 for galvanized finish) with a minimum yield point of 33,000 psi.

2.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Wall Framing: Steel framing / studs shall be of a configuration and gage to provide sufficient stiffness, as controlled by the maximum allowable horizontal deflection, under full live load, dead load and wind load of 1/600 of the wall height when secured to masonry veneer and 1/360 in all other areas.
      b. Interior Non-Load-Bearing Wall Framing: Steel framing / studs shall be of a configuration and gage to provide sufficient stiffness, as controlled by the maximum allowable horizontal deflection of L/360 of the wall height under a horizontal load of 10 lbf/sq. ft. in all areas (U.N.O.).
      c. Soffit / Ceiling Framing: Vertical deflection of 1/360 of the horizontally projected span for live load and 1/240 for total loads in all areas.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1/2 inch.

5. Steel framing / studs secured to masonry veneer shall be minimum 18 gauge with maximum spacing not to exceed 16 inches on center.
6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:
1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. 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.

2.04 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As Indicated.
2. Flange Width: As Indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

2.05 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.

4. End clips.
5. Gusset plates.
6. Stud kickers, knee braces, and girts.
7. Backer plates.

2.06 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.08 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL
A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and

thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
a. Install solid blocking at centers indicated.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.05 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Submit certified field reports, indicating that the metal framing, including corrected deficiencies as erected meets all of the requirements of the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

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. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Loose bearing and leveling plates.
   4. Miscellaneous steel trim.
   5. Aluminum Architectural Components including canopies.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Division 5 Section "Structural Steel."

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

B. Delegated Design: Engage a qualified professional engineer to design aluminum framing.

C. Structural Performance: Provide aluminum framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Vertical deflection of 1/360 of the horizontally projected span for live load and 1/240 for total loads in all areas.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1/2 inch.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Delegated-Design Submittal: for Aluminum Architectural Components

Shop Drawings: Submit placement drawings for framing members showing size and gage designations, number, type, locations, and spacing. Indicate reinforced channels, opening framing, supplemental strapping, bracing, bridging, splices, connection details, accessories and details required for proper installation. Shop Drawings shall be signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by the contractor.

1. Include fully dimensioned and detailed drawings of special components not covered by Product Data.
2. Submittal to include complete design calculations signed and sealed by registered Professional Engineer, licensed in the state in which project is located and employed by contractor.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."

B. Engineering Responsibility: Preparation of Shop Drawings, connection design calculations, and other structural data by a qualified professional engineer.

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

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Machine Screws: ASME B18.6.3.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

I. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   1. Use primer with a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
   1. Use primer with a VOC content of 420 g/L **(**or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1.Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Epoxy Coat miscellaneous framing, supports, connectors and fasteners exposed to moisture (U.N.O.).

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Epoxy Coat loose steel lintels located in exterior walls.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Epoxy coat exterior miscellaneous steel trim.

2.11 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3, unless otherwise indicated.
   2. Space siderails 18 inches apart, unless otherwise indicated.
   3. Support each ladder at top and bottom and not more than 48 inches **o.c.** with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:
   1. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
   2. Rungs: 3/4-inch- diameter steel bars.
   3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
   6. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

2.12 LADDER SAFETY CAGES

A. General:
1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.

B. Steel Ladder Safety Cages:
1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.
4. Prime interior ladder cages, including fasteners, with zinc-rich primer.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonshrink, nonmetallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Epoxy Coated Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 51 33

METAL LADDERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

The extent of aluminum ladders is indicated on the drawings and includes fixed wall mounted access ladders, cages and platforms.

1.2 SYSTEM PERFORMANCES

A. Safety Requirements: Manufacturer shall certify compliance with OSHA/ANSI A14.3 standards and MOSHA requirements.

1.3 QUALITY ASSURANCE

A. Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for products and processes used in ladders.

B. Shop Drawings:

1. Submit shop drawings for fabrication and erection of ladders. Include plans, elevations and details of fittings, connections, and anchorages to other work. Provide templates for anchor and bolt installation by others.
2. Where materials or fabrications are indicated to comply with certain requirements for design loading's, include structural computations, material properties and other information needed for structural analysis.

1.5 WARRANTY

A. Limited Warranty: Five years against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer’s plant which warrants same.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Products specified are manufactured by precision Inc. Ladders manufactured by the following companies will be considered for substitution, using manufacturer's standard components, fabricated to conform to specified performance characteristics and applicable standards.

1. Precision Ladder Inc
2. O’Keefe’s Ladder, Inc.
3. Alaco Ladder Company

B. Ladders shall be prefabricated and shall be manufactured by reputable company engaged in the business of manufacturing aluminum ladders. Field fabricated ladders shall not be acceptable.

2.2 ALUMINUM FIXED VERTICAL LADDER

A. Aluminum Floor Mounted Vertical Ladder (for use with roof hatch): Ladder, mounting brackets and handrails on both sides.

1. Model: Model FL Aluminum Ladder as manufactured by Precision Ladders, LLC., or approved equal, together with safety cage.
2. Capacity: Unit shall support a 1,500 lb total load without failure, and individual treads shall withstand a 3,000 lb loading without failure.
3. Ladder Tread: 2-1/4 inch by 3/4 inch by 1/4 inch extruded 6005-T5 aluminum with deeply serrated top surface.
4. Ladder Mounting Bracket: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick aluminum angle.
6. Floor Brackets: Floor bracket at foot of each stringer, 3 by 2 by 1/4 inch
7. Finishes:
   a. Standard: Mill finish on aluminum ladder components.

2.3 FABRICATION

A. General: Fabricate ladders to comply with reference Safety requirements and to manufacturer's standards. Provide ladder components in sizes and profiles required to support the loadings and comply with Standards.

B. Welded Connections: Fabricate ladders for interconnections of members by welding. Pre-assemble ladder units in shop to maximum extent practicable and consistent with shipping and handling limitations. Perform welding to comply with applicable AWS specifications, using method appropriate for metal and finish indicated. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

C. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings and anchors for interconnection of ladder to other work. Furnish inserts and other anchorage devices for connecting ladders to concrete or masonry work. Fabricate and space anchorage devices as required to provide adequate support. Coordinate anchorage devices with supporting structure.

2.4 METAL FINISHES

General: Provide mill finish on aluminum ladder components.

PART 3 - EXECUTION

3.1 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for adjustments during installation where taking field measurements before fabrication might delay work.

3.2 INSTALLATION

A. General:
   1. Fit exposed connections accurately together to form tight, hairline joints.
   2. Perform cutting, drilling and fitting required for installation of Ladders. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   3. Install metal ladders, accessory structures, and anchorages in accordance with manufacturer’s instructions.

B. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Grind exposed joints smooth.

C. Attachment of Ladder Assembles to the Building:
General:
1. Secure ladders to building with manufacturer's standard brackets and fittings, unless otherwise indicated.
2. For concrete and solid masonry, use drilled in expansion shields and anchor bolts, unless otherwise indicated.

3.3 ADJUST AND CLEAN

Protect finishes of ladders from damage during construction period. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items, which cannot be refinished in the field, to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION

SECTION 05 52 00

METAL RAILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES
Steel pipe handrails, balusters, and fittings for exterior installations.

1.2 DESIGN REQUIREMENTS
A. General: Comply with Code loading requirements applicable to handrails and railings.
1. Design in compliance with IBC 2021 Code.

B. Design assembled components to include requirements of sizes and spacings as indicated on drawings.

1.3 SUBMITTALS
A. Shop Drawings: Indicate profiles, sizes, joints and inter-sections, minimum bend radii, mounting brackets, connection attachments, anchorage, size and type of fasteners, and accessories.

B. Certification: Fabricator's certification to galvanizer, that fabrication to vent assembly specified under Article "Design Requirements" of this Section is present; is adequate to relieve destructive pressure during galvanizing; and is properly sized and fabricated to drain excess, molten galvanizing upon withdrawal from galvanizing tank.

1.4 QUALITY ASSURANCE
A. Verify all controlling dimensions by field measurement, prior to start of fabrication.

B. Do not field modify galvanized or shop-finished items, unless otherwise directed.

PART 2 - PRODUCTS

2.1 STEEL RAILING SYSTEM
A. Pipe: ASTM A 53, Type E, Grade B, Schedule as indicated on Drawings.

B. Pipe Diameters:
1. Toprail and post: 1-1/2 (1.66) inches, outside diameter.
2. Intermediate rails: 1-1/4 (1.315) inches.

C. Mounting: Brackets and flanges, with steel inserts for casting in concrete or with steel brackets for embedding in masonry.

D. Exposed Fasteners: Flush, countersunk-head, tamperproof type.

E. Splice Connectors: Steel welding collars.

2.2 FABRICATION
A. Fit and shop assemble components in largest practical sizes, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Continuously seal joined pieces by continuous welds.

F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

G. Accurately form components to suit stairs and landings, to each other and to building structure.

H. Toe Plates: Where shown or required, supply toe plates at unprotected openings, edges, and stair landings. Fabricate from steel plate or bar stock. Install so as to provide protection to a height of 4 inches from horizontal surfaces with a maximum 1/2-inch gap between bottom of toe plate and protected surface. Weld plates to railing posts and other structural members.

I. Galvanizing: Where shown or directed, perform galvanizing as follows:
   1. Preparation:
      a. Remove all weld spatter, flash, and flux. Prepare surfaces to be galvanized in accordance with SSPC SP-6, Commercial Blast Cleaning.
      b. Prior to galvanizing, perform acid descaling (pickling) on fabricated steel pipe assemblies. Drain, neutralize, and rinse interior thoroughly before galvanizing.
   2. Hot-dip galvanize steel-pipe assemblies after fabrication in accordance with ASTM A 384, ASTM A 385, and ASTM A 386. Galvanize structural shapes, bars, plates in accordance with ASTM A 123.
   3. After galvanizing and prior to finishing, remove all sharp peaks, dross spikes, sharp protrusions, and make exposed surfaces safe for finger contact.

2.3 FINISHING

A. Clean surfaces to be finished of rust, scale, grease, and other contaminants in accordance with SSPC SP-1, SP-2, and SP-6, as well as the paint and coating manufacturer's published instructions.

B. After cleaning, apply shop primer.

C. Where items are to be shop finished, provide temporary protection that will prevent damage to finishes during delivery.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry placed in partitions with setting templates, to appropriate Sections.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, or angles required for connecting railings to structure. Anchor railing to structure.

C. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

D. Conceal bolts and screws whenever possible. Where not concealed, use security type flush countersunk fastenings.

E. After installation is complete, touch-up all abraded and damaged coatings and galvanizing using galvanizing repair compound, primer, and coatings specified, as required.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4-inch per story, noncumulative.

B. Maximum Offset From True Alignment: 1/4-inch.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Furnishing and installing rough carpentry, including rough hardware.
2. Rough carpentry consists of wood construction, both temporary and permanent that is not exposed to view in completed building. Rough carpentry work includes proper installation of grounds, wood or metal, nailing strips, blocking, etc., necessary or required to produce an adequate and substantial base for support of finishes, material, fittings and equipment.
3. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this section include rough carpentry for:
   a. Wood grounds, nailers, blocking and sleepers, including that required for roofing.
   b. Plywood sheathing

1.2 REFERENCES

A. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.

1. American Wood Preservers Bureau Standards
2. Western Wood Products Association Use Manual
3. American Plywood Association (APA) Design/Construction Guide

B. Plywood Product Standards: Comply with PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel indicated.

1.3 SUBMITTALS

A. Wood Treatment Data:
Fire Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.3 PRODUCT HANDLING

A. Protection:

1. Deliver material to job site and store, in safe area, out of way of traffic and shored up off ground surface.
2. Identify framing lumber by grades and store each grade separately from other grades.
3. Protect metals with adequate waterproof outer wrapping.
4. Use extreme care in offloading lumber to prevent damage, splitting, and breaking of materials.
5. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks. Do not store materials directly on the ground.

1.4 JOB CONDITIONS

Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.1 LUMBER: GENERAL

A. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

B. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

C. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 PLYWOOD

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 3/4".

2.3 MISCELLANEOUS LUMBER

A. Provide Construction Grade light framing size lumber of any species for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members. Provide kiln-dried lumber with 15% maximum moisture content.

B. Where rough carpentry work is exposed to the weather or, used as blocking or grounds in roofing, or in area of high relative humidity, provide stainless steel structural screw fasteners.

2.4 WOOD TREATMENT

A. Treatment Chemical Manufacturer's: Producer of chemical treatment products shall be recognized for production of wood fire retardant treatments.

B. Treatment Applicator: The fire-retardant treatment application plants shall be licensed and approved by the treatment chemical manufacturer.

C. Fire Retardant Treatment:

1. Where fire retardant wood or plywood is specified provide materials which comply with AWPA Standards for pressure impregnation with fire retardant chemicals, and which have a flame spread rating of not more than 25 when tested in accordance with UL Test 723 of ASTM E 84, and show no increase in flame spread and significant progressive combustion upon continuation of test for additional 20 minutes.
2. Provide materials which show no change in fire hazard classification when subjected to standard rain test (UL 790 of ASTM B 2898)
3. Use fire retardant treatment which will not bleed through or adversely affect the type of finish indicated and which does not require brush treatment of field made end cuts to maintain fire hazard classification.
4. Kiln-dry treated items to maximum moisture content of 19%
5. Provide UL label on each piece of fire-retardant lumber of plywood.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. All fasteners shall be Type 304 stainless steel.

2.6 OTHER MATERIALS

A. Contractor selects other materials, not specifically described but required for a complete and proper installation, subject to Architect's approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
   2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
   3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
   4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

B. Wood Grounds, Nailers, Blocking, and Sleepers:
   1. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
   2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise show.
   3. Provide stainless steel fasteners when anchoring

C. Plywood Backing Panels: Nail to supports

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of other sections.

A. Types of finish carpentry work in this section include: Interior running and standing trim.

1.2 SUBMITTALS

A. Product Data:
Submit manufacturer's specifications and installation instructions for each item of factory fabricated siding and paneling.

B. Samples:
Submit the following samples for each species and cut or pattern of finish carpentry.
1. Interior standing and running trim: 2'-0" x full board or molding width, unfinished.

C. Wood Treatment Data:
Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials.

1.3 JOB CONDITIONS

A. Conditioning:
1. Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity conditions have stabilized and will be maintained in installation areas.
2. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

PART 2 – PRODUCT

2.1 WOOD PRODUCT QUALITY STANDARDS

A. Hardwood Lumber Standard:
Comply with National Hardwood Lumber Association rules.

B. Woodworking Standard:
Where indicated for a specific product comply with specified provision of the following: Architectural Woodwork Institute "Quality Standards".

2.2 MATERIALS

A. General:
Nominal sizes are indicated on the drawings, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.

B. Moisture Content of Hardwood Lumber:

Provide kiln-dried (KD) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.

C. Lumber for Transparent Finish (Stained or Clear):
Use pieces made of solid lumber stock.

2.3 INTERIOR FINISH CARPENTRY

A. Standing and Running Trim for Transparent Finish:
Plain Sawn Red Oak manufactured to sizes and patterns (profile) shown from selected First Grade Lumber (NHLA); complying with following grade requirements of referenced woodworking standard, for quality of materials and manufacture:
1. Grade: Premium

B. WM/Series Wood Molding Patterns:
For stock molding patterns graded under Wood Molding and Millwork Producers Industry WM 4, provide the following grade based on finish indicated and fabricated from any Western softwood species graded and inspected by WWPA.
1. Moldings for Transparent Finish: N-grade
2. Moldings for Painted Finish: P-Grade

C. Standing and Running Trim for Painted Finish: Eastern Poplar, FAS grade boards and custom profiles cut to shapes indicated.

2.4 INTERIOR MILLWORK

A. Interior Rail and Miscellaneous Millwork:
1. FSC-certified, solid dimensional lumber

2.5 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages:
1. Provide nails, screws and other anchoring devises of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Adhesives:
1. Interior Woodwork and Millwork: Low-VOC, FS MMM-A-125C, Type II, water- and mold-resistant. Use ASTM D3110, dry-use type for laminated and finger-jointed members, certified in accordance with ASTM C557 and complying with required VOC regulations.
a. Water-based contact cement
b. Water-based construction adhesive

PART 3 – EXECUTION

3.1 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

3.2 FINISH CARPENTRY INSTALLATION

A. General:
1. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to babricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.
2. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level

countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

3. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

B. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.

C. Anchorage and Fasteners.

1. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.

C. Contractor shall maintain conditions necessary to ensure that work will be without damage or deterioration at the time of acceptance.

END OF SECTION

SECTION 06 61 19

QUARTZ SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz countertops.
2. Setting materials and accessories.

1.2 REFERENCES

A. ASTM International (ASTM)

1. C97 – Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
2. C99 – Standard Test Method for Modulus of Rupture of Dimension Stone.
3. C170 – Standard Test Method for Compressive Strength of Dimension Stone.
4. C256 – Method of Test for Flexural Strength of Magnesium Oxychloride Cements (Using Simple Bar with Two-Point or Single-Point Loading.)
5. C370 – Standard Test Methods for Moisture Expansion of Fired Whiteware Products.
6. C373 – Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products.
7. C484 – Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
8. C531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant mortars, Grouts, Monolithic Surfacings and Polymer Concretes.
9. C648 – Standard Test Method for Breaking Strength of Ceramic Tile.
10. C650 – Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
11. C672/C672M – Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
12. C674 – Standard Test Methods for Flexural Properties of Ceramic Whiteware Materials.
13. C880 – Standard Test Method for Flexural Strength of Dimension Stone.
14. C1026 – Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling.
15. C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
16. C1378 – Standard Test Method for Determination of Resistance to Staining.
17. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. NSF International/American National Standards Institute (NSF/ANSI) 51 – Food Equipment Materials.

C. Underwriters Laboratories, Inc. (UL) 94 – Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.

1.3 SUBMITTALS

A. Submittals for Review: Shop Drawings: Include layout, dimensions, materials, finishes, cutouts, and attachments.

B. Samples: 12 x 12 inch quartz samples in specified color.

C. Closeout Submittals: Maintenance Data: Include recommended cleaning materials and

procedures, and list of materials detrimental to quartz.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum 10 years experience in manufacture of quartz surfacing materials.
   2. Current USGBC Environmental Management System Certificate holder.

B. Fabricator and Installer Qualifications: Minimum 2 years experience in work of this Section.

1.5 WARRANTY

Provide manufacturer's 10 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by Cosentino USA, Inc. (www.cosentinousa.com)

2.2 MATERIALS

A. Quartz Sheet:
   1. Product: Silestone Quartz.
   2. Composition: Quartz aggregate, polyester resin, and color pigments formed into flat slabs.
   3. Bacteriostatic Protection with Silver Technology.
   4. Color: White Storm
   5. Surface finish: Polished
   6. Thickness: ¾ inches.
   7. Physical characteristics:
      a. Static coefficient of friction: 0.75 dry, 0.68 wet, tested to ASTM C1028.
      b. Water absorption: 0.03 percent, tested to ASTM C97.
      c. Compressive strength: 29,100 psi, tested to ASTM C170.
      d. Bond strength: 235 psi, tested to ASTM C482.
      e. Modulus of rupture: 6310 psi, tested to ASTM C99.
      f. Flexural strength: 5840 psi, tested to ASTM C880.
      g. Breaking strength: 480 lbf, tested to ASTM C648.
      h. Impact strength: Minus 352 feet, tested to ASTM C256.
      i. Density: 2.47 grams per cubic centimeter, tested to ASTM C373.
      j. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
      k. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
      l. Abrasive index: 65-Ha = 25, tested to ASTM C241.
      m. Thermal expansion: 1.670 x 10 in/in/deg F, tested to ASTM C531.
      n. Deicing resistance: Rating of 0, tested to ASTM C672/C672M
      o. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
      p. Flame spread rating: Class 1, tested to ASTM E84
      q. Flammability: Bet rating, tested to UL 94.

2.3 ACCESSORIES

A. Adhesive: Type recommended by quartz manufacturer.

2.4 FABRICATION

A. Cut quartz panels accurately to required shapes and dimensions.

B. Fabricate exposed edges to bullnose edge profile.

C. Fabricate with hairline joints.

D. Cut holes for sinks, faucets, and openings.

PART 3 - EXECUTION

3.1 PREPARATION

Clean surfaces to receive fabrication; remove loose and foreign matter than could interfere with adhesion.

3.2 INSTALLATION

A. Install fabrications in accordance with manufacturer's instructions and approved Shop Drawings.

B. Adhere fabrications with continuous beads of adhesive.

C. Set plumb and level. Align adjacent pieces in same plane.

D. Install with hairline joints

E. Fill joints between fabrication and adjacent construction with joint sealer, finish smooth and flush.

3.3 INSTALLATION TOLERANCES

A. Maximum variation from level and plumb: 1/8 inch in 10 feet, non cumulative.

B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

3.4 CLEANING

Protect installed fabrication with nonstaining sheet coverings.

3.5 PROTECTION

Protect installed fabrications with nonstaining sheet coverings.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The extent of insulation work is shown on the drawings and indicated by the provisions of this section.

B. Applications of insulation specified in this section include the following:
   1. Blanket type building insulation

1.2 QUALITY ASSURANCE

A. Thermal Conductivity: Thicknesses indicated are for thermal conductivity specified for each material at 75 degrees F. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide thickness required to achieve indicated value.

B. Fire and Insurance Ratings: Comply with fire resistance, flammability and insurance ratings indicated, and comply with regulations as interpreted by governing authorities.

C. Federal Specifications: Where compliance with FS standard is indicated, specified requirements for marking individual boards/batts/blankets are waived, provided packages of units are labeled to show compliances.

D. Blown-In Certification: Installer must sign, date and post certification somewhere in the building that is easily accessible to the building Owner and all inspection agencies.

1.3 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.
   2. Certified Tests: With product data, submit copies of certified test report showing compliance with specified performance values, including k-values, densities, compression strengths, burning characteristics, perm ratings, water absorption ratings and similar ratings.

B. Test Reports: Submit laboratory test report on each frothed or foamed-in-place insulation sample, indicating required test results, general location of work represented by sample, and date of sample.

1.4 PRODUCT HANDLING

A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do deliver plastic insulating materials to project site ahead of installation time. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

C. Storage: Store insulation under cover and protect from weather.

PART 2 - PRODUCTS

2.1 INSULATION

A. Mineral Wool Insulation:
1. Provide "Thermafiber Fire & Sound Guard Plus" by Owens Corning or approved equal.

2.2 SOUND BATTS

A. Sound Batts (Sound and Fire Rated Partitions);
1. Material - paperless, semi-rigid, spun mineral fiber blankets. Federal specification HH-I-521E type I, class A, UL rated.
2. Size 3-1/2" thick, full width of stud space by 96 inch blankets.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor barriers.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
3. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

B. General Building Insulation:
1. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
2. Nail composite nailable urethane board insulation units to deck or other structural substrates with ringed shank nails of the spacing, size and length required for substrate penetration as recommended by board manufacturer. Stagger joints one direction at least 12". On wood substrates, provide 1/8" expansion space between insulation board edges. Install each area of insulation in a surround of wood blocking of thickness equal to composite board thickness.

3. Seal joints between closed-cell insulation units by applying mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in complete installation with mastic or sealant.
4. Set vapor barrier faced units with vapor barrier to warm side of construction, except as otherwise shown. Do not obstruct ventilation spaces, except for firestopping.
5. Tape joints and ruptures in vapor barriers, and seal each continuous area of insulation to surrounding construction to ensure vapor tight installation.
6. Set reflective foil faced units accurately with air space in front of foil as shown. Provide not less than 0.75" air space where possible.
7. Pour granular insulation into spaces and onto surfaces as shown. Screed horizontal applications to uniform thicknesses required.
8. Place loose fiber insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing. Level horizontal applications to uniform thickness as indicated, lightly settled to uniform density, but not excessively compacted.
9. Chink around windows and doors in exterior walls with mineral wool insulation.

3.3 PROTECTION

Protect installed insulation and vapor barriers from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure. Installer shall advise Contractor of exposure hazards, including possible sources of deterioration and fire hazards.

END OF SECTION

SECTION 07 53 23

FLEXIBLE SHEET ROOFING
TPO MEMBRANE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of flexible sheet roofing (FSR) is indicated on the drawings and is hereby defined to include non-traffic bearing sheet membrane system intended for weather exposure as primary roofing.

B. Roof insulation related to flexible sheet roofing is specified in this section.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain primary flexible sheet roofing from a single manufacturer. Provide secondary materials as recommended by the manufacturer of primary materials.
   2. Roofing manufacturer shall be an established manufacturer of roofing materials specified, maintaining technically qualified personnel, in the project area, to review proposed construction, consult at the project site, make detailed recommendations concerning installation procedures, etc.

B. Installer:
   1. A firm with not less than 5 years of successful experience in the installation of roofing systems identical to those required for this project and which is licensed by the manufacturer of primary roofing materials.
   2. Provide written certification from manufacturer of roofing system that Installer is approved by manufacturer for installation of specified roofing system. Submit copy of certification to Architect.
   3. Installer shall maintain a full-time supervisor at the site of the work at all times when roofing work is in progress. Supervisor shall have a minimum of 3 years experience as a supervisor of roofing work.

C. Pre-Roofing Conference:
   Prior to installation of roofing and associated work, meet at project site with Installer, roofing manufacturer, installers of related work, and other entities concerned with roofing performance, including test agencies, Architect, and Owner.

D. UL Listing:
   1. Provide labeled materials which have been tested and listed by UL for application indicated, with the following rating for roof slopes shown:
      a. Class A rated materials/system

E. Inspection:
   1. Upon completion of the installation, a certified technical representative, unrelated to the sales department of the manufacturer or the contractor shall inspect the roofing system to determine that it has been installed according to the Manufacturer's published specifications and details. Upon approval of the project by Manufacturer, a warranty shall be written.

F. Changes or deviations from this Specification shall be approved in writing by Manufacturer, and be acceptable to the Architect.

1.4 SUBMITTALS

A. Product Data: Submit specifications, installation instructions and general recommendations from manufacturers of flexible sheet roofing system materials, for types of roofing required. Include data substantiating that materials comply with requirements.

B. Samples: Submit 12" squares of roof insulation.

C. Shop Drawings: Provide roof plan indicating slope, slope direction, and insulation layout. Provide details for all penetrations, transitions and terminations of the membrane.

D. Warranty:
1. Provide manufacturer's warranty stating obligations, remedies, limitations, and exclusions.
2. Provide Roofing Contractor's written warranty.

E. Adhesion Test (Gypsum Deck): Submit a complete listing of adhesion tests conducted and the corresponding adhesion values, signed by the representative conducting the test and the roofing applicator verifying the accuracy of the test.

F. Certifications:
1. Provide certification of installer by manufacturer.
2. Submit certification that installer is a Manufacturer Approved Applicator.
3. Submit U.L. Class A and FM I-90 references/ approvals for the assembly to be installed.
4. Submit testing or proof of resistance to chemicals or materials that may deteriorate the membrane.
5. Submit certification of ten years experience in the manufacturing of the membrane.
6. Submit proof of a minimum of 4,000,000 Langleys of Emmaqua testing per ASTM G-90.
7. Submit proof of ISO 9002 certification of membrane manufacturing facilities.

G. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements of warranty.

H. Inspection Report: Copy of roofing system manufacturer’s inspection report of completed roofing installation.

1.5 PRODUCT HANDLING, STORAGE AND DELIVERY

A. Deliver material in manufacturer's original containers with labels intact and legible.

B. Deliver bulk shipments with certification of compliance with specifications including melting point, flash point, application temperature, etc.

C. Select and operate material handling equipment and store materials to keep from damaging existing construction or applied roofing.

D. Store rolls of membrane, cartons and drums of adhesives, all cans and drums of cement, primers, and coatings on end.

E. Store materials on clean, raised platforms.

F. Store and handle materials to protect them from:

1. Moisture, whether due to rain, snow or condensation
2. Damage by construction traffic
3. Temperatures over 110 degrees Fahrenheit
4. Temperatures below 40 degrees Fahrenheit
5. Direct sunlight
6. Mud, dust, sand, oil, grease and dirt.

Note: Polyethylene is not acceptable as a cover, use opaque tarpaulins.

G. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

H. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

I. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

J. Damaged materials shall be replaced at the Contractor's expense.

K. Immediately remove and dispose of wet materials.

L. Comply with fire, safety, and environmental protection regulations.

M. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.6 WEATHER CONDITIONS

A. Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

B. Do not apply roofing when ambient temperature is below 40 degrees F and substrate, or when wind speed is over 20 miles per hour.

1.7 PROTECTION

A. Avoid heavy traffic on the work during all phases of installation.

B. Replace or restore to original condition any materials or work damaged during construction.

C. Protect exterior building and paving surface with tarpaulins in the area of the work during roofing work, including tear-off areas, hoists, dumpster, dump trucks, etc.

D. Lap protective materials at least 6 inches and secure protective coverings against wind.

E. Leave protective covering in place until roofing work is completed.

F. Protect the building interior from water infiltration at all times. Do not tear off more roofing than can be replaced by the end of the work day.

1.8 MISCELLANEOUS

A. Do not use bitumen base roof cement on FSR system.

B. Do not install FSR membrane directly onto low melting point asphalt.

C. Do not allow waste products, petroleum, grease, oil solvents, vegetable or mineral oil, animal fat, etc. or direct steam venting to come in contact with the membrane.

D. Roof surface shall be free of ponded water, ice or snow.

1.9 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty:
   1. The manufacturer of the roofing system shall issue the warranty for a thirty (30) year period with No Dollar Limit on replacement costs. This warranty shall insure that the roofing system installed remains watertight for thirty years after Substantial Completion and that the manufacturer guarantees to correct/repair all leaking roof systems during the warranty period free of charge.
   2. The cost of the manufacturer's warranty shall be included in the Base Bid of the Contract and shall be the sole responsibility of the Contractor to obtain.
   3. The work of the Contract will not be considered Substantially Complete until the manufacturer's warranty is issued, and the work is found to be acceptable to the Owner.
   4. The warranty shall contain no exclusion or limitation for improper installation; or damage from environmental contaminants; or damage from water that ponds, or does not drain freely.

C. Installer's Warranty:
   1. Provide Roofing Contractor's written warranty to repair or replace any component of the roofing system, including but not limited to, roof membrane, insulation, flashing, metal coping and metal flashing, for a period of 2 years.
   2. Repairs during the warranty shall be made at no cost to the Owner within (48) hours of notification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Performance:
Provide roofing materials recognized to be of generic type indicated and tested to show compliance with indicated performances, or provide other similar materials certified in writing by manufacturer to be equal or better than specified in every significant respect, and acceptable to the Architect.

B. Compatibility:
Provide products which are recommended by manufacturers to be fully compatible with indicated substrates or provide separation materials as required to eliminate contact between incompatible materials.

2.2 ADHERED FSR SYSTEM

A. Thermoplastic Polyolefin
   1. TPO Membrane: TPO (thermoplastic Polyolefin) w/ a 1000 denier polyester weft inserted reinforcement flexible sheet fully adhered roofing system.

2. Manufacturer's standard thickness but not less than .080 inches, 30% minimum elongation (ASTM D751), ultraviolet and ozone resistant, low temperature brittleness of -40 degrees F (ASTM D2137), in standard tan color, all in compliance with ASTM D 4637 Type I.
3. Radiative Properties

	Test Method	Tan TPO
Energy Star – Initial solar reflectance	Solar Spectrum Reflectometer	0.71
Energy Star – Initial solar reflectance after 3 years	Solar Spectrum Reflectometer (uncleaned)	0.64
CRRC – Initial solar reflectance	ASTM C1549	0.71
CRRC – Solar reflectance after 3 years	ASTM C1549 (uncleaned)	0.64
CRRC – Initial thermal emittance	ASTM C1371	0.86
CRRC – Thermal emittance after 3 years	ASTM C1371 (uncleaned)	0.87
LEED – Thermal emittance	PASS	0.86
SRI – Initial (Solar Reflectance Index)		86
SRI – 3 year aged (Solar Reflectance Index)		77

4. Products: Subject to compliance with the specified requirements, provide flexible sheet roofing system; "UltraPly Platinum TPO" from Elevate Building Products (Basis of Design), "Sure-Weld Adhered TPO" from Carlisle Syntec", or approved equal.

2.3 MISCELLANEOUS MATERIALS FOR FSR

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with FSR membrane roofing.

B. Flashing: 60 mil thick TPO, cured or un-cured according to application. For field fabricated vent stacks, pipes and corners provide unreinforced 55 mil thick white Ethylene propylene.

C. Sheet Seaming System:
Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by manufacturer of FSR system.

D. Bonding Adhesive: Type recommended by manufacturer for FSR membrane for particular substrate and project conditions and formulated to withstand minimum 60 psf uplift force.

E. All caps are to be heat welded.

F. Cut Edge Sealant: Manufacturer's standard single component sealant.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, roll formed and pre-punched.

I. Fasteners: Polymer anchors designed for fastening roofing insulation to te
deck substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer. Provide coated steel fasteners and plates for metal deck areas of the roof.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam

sealants, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

K. Molded Pipe Flashing: Provide factory fabricated molded pipe flashing compatible with FSR membrane and furnished by FSR manufacturer for each pipe penetration of the roofing system.

L. Walkway Pads: Provide roof material manufacturer's standard walkway pad, 34" x 10' x 80 mil, thick rolls, for installation with splice adhesive to the roof membrane.

2.4 INSULATION

A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated. Insulation system shall include preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated and as required by Code.

B. Polyisocyanurate insulation shall be manufactured utilizing "Zero ODP" pentane blowing agents complying with ASTM C 1289-02, and classified by facer type as follows:
   1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.
   2. Flat Polyiso board Insulation: Flat, rigid, cellular polyiso thermal insulation with an LTTR R-Value of 30 and thickness of five (5") inches.
   3. Tapered Polyiso Board Insulation: ¼" slope, rigid, polyiso thermal insulation with an overall average LTTR R-Value of 30 and a minimum thickness required to meet specified R value.
   4. Tapered crickets as indicated on drawings or where needed for positive drainage shall be sloped ½" per foot with a minimum thickness of ½".

C. Overlay Board: Where indicated as "Overlayment" on the drawings, provide glass fiber faced gypsum sheathing, non-structural, glass mat faced, silicone treated gypsum core, Georgia Pacific Building Products "DensDeck" boards, USG Securock, 1/2" thick, Carlisle Syntec SecurShield HD (Basis of Design), or approved equal.

D. Insulation and Overlay Board Adhesive: An elongating impact resistant two component insulating urethane adhesive.

E. Vacuum Insulated High R-Value Insulation Panels: Provide Advanc-R vacuum insulated panels and coordinating rigid thermoset polyisocyanurate infill panels by Panasonic, or approved equal. Coordinate with manufacturer regarding panel layout to maximize efficiency. Install in accordance with manufacturer's recommendations regarding proper bonding adhesive.

2.5 INSULATION ACCESSORIES

A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer. Provide fasteners with factory applied white finish.

2.6 VAPOR BARRIER

A. Composite Aluminum foil with a tenacious shelf adhesive SBS backing and removable poly release film.
   1. Basis of Design: Elevate V-Guard

2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   a. GAF
   b. Versico Roofing Systems
   c. Johns Manville
   d. Carlisle
3. Tape: Pressure-sensitive tape of type recommended by vapor barrier manufacturer for sealing joints and penetrations in vapor barrier.
4. Adhesive: Manufacturer's standard lap adhesive, listed by FM Approvals for vapor barrier application.

PART 3 - EXECUTION

3.1 PRECAUTIONS AND PROTECTION OF STRUCTURE

A. Limitations of Roof Load:
The Contractor shall be responsible for limiting the imposed loads on the building structure. This includes dead loads and live loads resulting from, but not limited to:
1. the storage of materials, supplies, and equipment
2. personnel on the roof
3. impact loads from transport equipment

B. Engineer's Certification:
The Contractor shall engage, and pay for, the services of a registered professional structural engineer to certify that the structural capacity of the building structural support system is adequate to support the loads that are imposed by the Contractor's operations.

C. Restrictions on Equipment:
The Contractor shall not use motorized vehicles or equipment on the roof that incorporate a cab for the operator; such as a Bobcat front end loader.

3.2 DEMOLITION OF EXISTING ROOFING

A. General:
1. Cut existing roofing for demolition, do not use axes or impact tools.
2. Remove existing roofing and insulation material completely. Where indicated on the drawings remove existing metal flashing.
3. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
4. Protect existing roof drains from being clogged with debris.
5. Proceed with demolition in systematic manner. Do not remove more roofing than can be replaced before the end of daily operations.
6. Make the roof system weatherproof and waterproof at the end of each day's operations.
7. Conveyances: Contractor shall transport demolition debris across roof in vehicles that will not damage or overload the roof deck.
8. Clean all debris.
9. Protect existing gypsum roof deck scheduled to remain.

B. Demolition Plan:
The Contractor shall submit a detailed roofing demolition plan that describes the equipment and methods to be used, refuse storage and removal processes, and the proposed disposal methods. The plan shall also include methods for protecting the building interior and exterior, traffic control, occupant protection, and security of the construction site.

C. Demolition Equipment and Methods:

1. Scrape off existing roofing, do not use axes or impact tools.
2. Roof cutting power tools shall be equipped with operable blade depth setting mechanisms which shall control the cutting depth of the blade. The Contractor shall take every precaution to avoid cutting the decking. The Contractor shall repair all decking that is damaged by the demolition operation at the Contractor's expense.
3. The use of "bobcat" type removal equipment is prohibited.
4. The Contractor shall provide chutes for debris to be transferred to containers at grade. Protect the wall behind and adjacent to chute locations with tarpaulins.
5. Removed materials shall not be thrown freely from the roof but shall be lowered to the ground by mechanical devices or in an enclosed chute. Contractor shall minimize the spread of dust and debris.

D. Disposal of Demolished Materials:
1. Remove from site all debris, rubbish, and other materials resulting from demolition operations.
2. Transport materials removed from demolished structures and dispose of off-site in accordance with regulations and authorities having jurisdiction.
3. Contractor shall submit to the Owner for approval, all crane and refuse container locations. The Contractor shall repair any lawns or paving damaged during the Contract to original, or better, condition.

3.3 PREPARATION OF SUBSTRATE

A. Comply with manufacturer's instructions for preparation of substrate to receive system, except where more stringent requirements are indicated.

B. Clean substrate of dust, debris, and other substances detrimental to new work. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Install flashings, and accessory items as shown, and as recommended by the manufacturer even though not specifically shown.

F. Verify that work requiring penetration of the deck, or that requires men and equipment to travel over the roof deck has been completed.

G. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

H. Confirm that all surfaces are adequately anchored, even and free of any foreign material, moisture, or un-evenness.

I. Immediately notify the Architect of any defects. Do not apply the roofing system until these defects have been corrected.

J. Verify that curbs and nailers are in place and properly installed.

3.4 ADHESION TESTS (Gypsum Deck)

A. Conduct (6) adhesion tests in accordance with manufacturer's instructions for every 10,000 square feet of roofing, but not less than (6) tests on each building.

3.5 INSULATION INSTALLATION- POLYISO INSULATION

A. General:

1 Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

2. Comply with roofing system manufacturer's written instructions for installing roofing insulation.
3. Extend insulation full thickness over the entire surface to be insulated, cutting and fitting tightly around obstructions. Form crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane.
4. Do not use any damaged or wet insulation boards.
5. Install insulation boards with not more than 1/4" gap between boards.
6. Poorly adhered boards and boards with more than 1/4" gap shall be removed and replaced.
7. Do not install more insulation each day than can be covered with membrane before end of day and before start of inclement weather.
8. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
9. Install tapered crickets wherever required to provide positive drainage around roof top equipment and accessories, whether shown on the drawings or not.
10. Install two layers of insulation under area of roofing to achieve required thickness. Joints are to be staggered between rows and layers.
11. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.
12. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼ inch (6 mm) with insulation.
    a. Cut and fit insulation within ¼ inch (6 mm) of nailers, projections, and penetrations.

B. Gypsum Deck Installations

1. Attached Insulation: Install all layers of insulation using the two-component urethane adhesive in accordance with the manufacturer's specifications.
2. Install the overlay board to the top surface of the polyiso insulation using the two-component urethane adhesive in accordance with the manufacturer's specifications.

3.6 INSULATION INSTALLATION- VACUUM INSULATED HIGH R-VALUE INSULATION PANELS

A. General:

1. Stagger seams of each layer to maximize R-Value
2. Only use manufacturer's approved adhesives to attach vacuum insulated panels to other layers of the roofing system. Do not use fasteners, screws, nails, staples, etc.
3. Install vacuum insulated panels at least 4-6" away from parapet walls, mechanical roof penetrations, or any other obstructions on the roof
4. Ensure no foreign or sharp objects touch the vacuum insulated panels, and that the panels are level. Do not step on vacuum insulated panels as this may compromise the outer-bad and thermal performance.
5. Ensure the vacuum insulated panels are kept dry at all times
6. Install with highly reflective side face up

3.7 FSR INSTALLATION

A. General:

1. Comply with manufacturers' published instructions, except where more stringent requirements are indicated.

2. Prevent compounds from entering and clogging drains and conductors, and from spilling or migrating onto surfaces of other work.

B. Adhesive Adhered FSR:
1. Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll FSR into place when adhesive has properly cured. Cut edges are to be sealed after seams have been welded.
2. Install mechanical fasteners, flashings and counterflashings, and accessories at locations and as recommended by manufacturer.
3. Install FSR sheet over area to receive roofing according to roofing system manufacturer's written instruction. Unroll sheet and allow to relax for minimum of 30 minutes.
4. Start installation of sheet in presence of roofing system manufacturer's technical personnel.
5. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
6. Apply bonding adhesive to substrate and underside of sheet at rate required by manufacturer and allow to partially dry. Do not apply bonding adhesive to splice area of sheet.
7. Mechanically or adhesively fasten sheet securely at terminations and perimeter of roofing.
8. Apply roofing sheet with side laps shingled with slope of roof deck where possible.
9. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring.

C. Walkpads:
Install walkpads in accordance with manufacturer's written instructions, placing pads with 4" space between each and anchoring pads with splice adhesive to the roof membrane.

3.8 SEAM INSTALLATION
A. Clean both faces of splice areas, heat weld laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation.

B. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

3.9 FLASHING INSTALLATION
A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with FSR flashing as recommended by manufacturer.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top sheet flashings.

F. Terminate and seal top of sheet flashing and mechanically anchor to substrate through termination bars.

3.10 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

3.11 PROTECTION AND CLEANING

A. Protect sheet membrane roofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.
   1. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of each type of flashing and sheet metal work is indicated on the drawings and by provisions of this section.

B. The types of work specified in this section include the following:
   1. Metal counter flashing; and base flashing
   2. Metal wall flashing and expansion joints
   3. Exposed metal trim
   4. Prefabricated coping
   5. Miscellaneous sheet metal accessories

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, installation instructions and general recommendations for each specified sheet material and fabricated product.

B. Shop Drawings: Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter flashings, trim/facia units, gutters, downspouts, scuppers and expansion joint systems; layouts at ¼" scale, details at 3" scale.

C. Samples: Submit two, 8" square samples of specified sheet materials to be exposed as finished surfaces.

1.3 QUALITY ASSURANCE

A. Job Conditions: Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protect of materials and finishes.

PART 2 – PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Aluminum: ASTM B 209, alloy 3003, temper H14, Kynar 500 finish; 0.40" except as otherwise indicated..

2.2 FORMED UNITS

A. General Metal Fabrication: Shop fabricate work to the greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder.

C. Expansion Provision: Where lapped or bayonet type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with industry standards.

E. Separation: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusion Units:
   1. Fabricate extruded aluminum running units with formed or extruded aluminum joint covers, for installation behind main members.
   2. Fabricate mitered and welded corner units.

G. Shop Finish, Rain Drainage: Provide manufacturer's standard baked on bronze acrylic ship finish on sheet metal rain drainage units (gutters, downspouts, and similar exposed units); 1.0 mil dry film thickness.

2.3 FABRICATED METAL ROOFING ACCESSORIES

A. Aluminum Coping
   1. Manufacturer's standard sizes and profiles or as indicated on the drawings, Kynar 500 finish, 0.050 minimum thickness for primary legs of extrusions.
   2. Provide prefabricated system including preformed coping, 6" splice plates, and 24-gauge hold cleats with integral neoprene compression pads. Splice plates shall be treated with factory applied sealant beads. Provide "PAC-LOC" coping system by Petersen Aluminum or approved equal.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

B. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.

PART 3 – EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a course of paper slip sheet and a course of polyethylene underlayment.

C. Installation:
   1. Bed flanges of work in roofing sealant where required for waterproof performance.
   4. Install elastic flashing without stretching. Install elastic flashing filler strips to provide for movement by forming loops of bellows in width of flashing. Locate filler strips to facilitate complete drainage of water from flashing. Seam flashing sheets with adhesive, and anchor edges in manner indicated.
   5. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6". Complete seams at joints between units, to form a continuous waterproof system.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

B. Contractor shall protect sheet metal and flashing work during construction to ensure that work will not be damaged.

END OF SECTION

SECTION 07 71 23

GUTTER AND DOWNSPOUT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Prefabricated prefinished gutters and downspouts complete with concealed splice plates, anchors and fasteners. See drawings for location.

1.2 PERFORMANCE CRITERIA

A. Thermal Movement:

1. Completed gutter and downspout system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
2. Gutters shall be tapered and notched to provide a 1" telescoping lap joint. Gutter shall be pre-punched at 12" o.c. to provide thermal movement.

B. Uniform Wind Load Capacity:

1. Installed gutter and downspout system shall withstand positive and negative design wind loading pressures complying with BOCA, 1990. Test pressures for testing purposes shall be in accord with the principles of ASTM E330, Procedure A, adapted to testing of gutters and downspouts as follows:
   a. Accessories shall be production materials of same type and thickness proposed for use on project.
2. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.

1.3 SUBMITTALS

A. Shop Drawings: Indicate material types, sizes, shapes, thickness, finishes, fabrication details, anchors, connections and relation to adjacent work. Details and profiles shall be drawn at appropriate scale.

B. Product Data: Indicate product description, finishes and installation instructions, including interface with adjacent materials and surfaces. Furnish standard and custom color charts.

1.4 QUALITY ASSURANCE

A. General: Comply with the following standards as referenced in this Section.

1. Aluminum Association, Design System for Aluminum Finishes (AA).
2. American Architectural Manufacturers Association (AAMA), standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials off ground, under cover. Protect from damage and deterioration.

B. Handle materials to prevent damage to surfaces, edges and ends of sheet metal items. Remove damaged material from site and replace with new products.

1.6 WARRANTY

A. Warrant coping work to be free of defects in materials and workmanship, to resist blow-off and to be weathertight, due to conditions within stated design limits. Provide 20-year

warranty based on independent certified testing for design and performance criteria of this Section beginning from Date of Substantial Completion.

B. Warrant fluoropolymer coating for 20 years, under normal atmospheric conditions, from peeling, checking or cracking (except for slight crazing as may occur on tightly roll-formed edges or brake bends at time of forming pre-painted sheet), caulking in excess of numerical rating of 8 when measured in compliance with ASTM D659-86, or fading in excess of 5 N.B.S. beginning from Date of Substantial Completion.

PART 2 – PRODUCTS

2.1 FORMED ALUMINUM GUTTER AND DOWNSPOUTS

A. Products:
1. Gutter Systems by Metal-Era Roof Edge Systems, or approved equal

B. Characteristics:
1. Material: Smooth surfaced formed aluminum alloy, minimum 0.063 inch thick with front and back drip legs factory roll-formed. Press braking of drip edges is unacceptable.
2. Finish: Custom color, fluoropolymer coating.
3. Gutter Size: 5 inches minimum and as indicated on drawings.
4. Downspout Size: 3 inches by 4 inches rectangular.

C. Accessories:
1. Fasteners: Types as recommended by manufacturer. Do not use adhesive without mechanical fastening devices.
2. Prefabricated Sections: Factory-assembled, mitered corners, and welded joints to match gutter and downspout in design and finish.

2.2 FINISH

A. Fluoropolymer Coating: Two-coat, shop-applied, baked-on fluoropolymer coating system.
1. Coating Thickness: 1.0 mil dry film thickness consisting of minimum 0.20 mil primer and minimum 0.80 mil color coat.
2. Color: As selected by Architect from coating system's selection for custom color.

B. Manufacturer: Atochem North America, Inc., Kynar 500 resin or Ausimont U.S.A., Inc., Hylar 5000 resin (polyvinylidene fluoride, PVDF), formulated by a licensed manufacturer and applied by manufacturer's approved applicator to meet AAMA Publication 605.2-90.

PART 3 – EXECUTION

3.1 PREFABRICATED GUTTER AND DOWNSPOUT INSTALLATION

A. Install prefabricated gutter and downspout system in compliance with manufacturer's product data and printed installation instructions.

B. Make watertight fit, allowing for expansion and contraction.

C. Install support brackets at 30" O.C. to allow a maximum 1/8" per 40 foot slope. Attach brackets with16d coated nail.

D. Install manufacturer's standard elastomeric expansion joint assembly at 40'-0" intervals.

E. End/Caps Terminations: Install manufacturer's end caps at all end terminations.

F. Miter all corners, install manufacturer's welded miters at corners.

G. Install gutter from left to right (roofside) into support brackets. Lap each telescoping section a distance of 1” seal and rivet at 2” O.C.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent and locations of roof accessories is indicated on the drawings and by provisions of this section.

B. The types of units specified in this section include the following:
   1. Prefabricated curb and support units
   2. Curb type expansion joints

1.2 QUALITY ASSURANCE

A. Standards: Except as otherwise indicated, comply with applicable provisions of SMACNA "Architectural Sheet Metal Manual".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, rough-in diagrams, details, installation instructions and general product recommendations.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

Provide manufacturers' standard units, modified as necessary to comply with requirements. Shop fabricate each unit to the greatest extent possible.

2.2 MATERIALS; GENERAL

A. Aluminum Sheet: ASTM B209, alloy 3003, temper as required for forming and performance; AA-C22A41 clear anodized finish, except mill finish prepared for painting where indicated for painting.

B. Extruded Aluminum: Manufacturer's standard extrusions of sizes and general profiles indicated, alloy 6063-T52; 0.078" minimum thicknesses for primary framing and curb member legs, 0.062" for secondary legs; AA-C22-A41 clear anodized finish on exposed members, except as otherwise indicated.

C. Insulation: Manufacturer's standard rigid or semi-rigid board of glass fiber of thicknesses indicated.

D. Wood Nailers: Softwood lumber, pressure treated with water borne preservatives for above ground use, complying with AWPB LP-2; not less than 1-1/2" thick.

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.

F. Gaskets Tubular or fingered design of neoprene.

G. Bituminous Coating: FS TT-C-494 or SSPC Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coating.

H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

I. Elastomeric Sealant: Generic type recommended by unit manufacturer, which is compatible with joint surfaces; comply with FS TT-S-0027, TT-S-00230, or TT-S-001543.

J. Roofing Cement: ASTM D 2822, asphaltic.

2.3 PREFABRICATED CURBS/EQUIPMENT SUPPORTS

A. General: Coordinate dimensions with shop drawings of equipment to be supported. Fabricate of structural quality galvanized sheet steel (ASTM A 525 G 90). Fabricate with welded corner joints, and with cant strips and base profile coordinated with roof insulation thickness. Provide wood nailers at tops of curbs, coordinate with thickness of insulation and roof flashing as indicated, and tapered where necessary to compensate for roof deck slopes of 1/4" per feet and less. Except as otherwise indicated or required for strength, fabricate units of minimum 14 gage (0.0747") metal.

B. Equipment Curbs and Pipe Saddles:
   1. Fabricate units of sizes shown, for 40 pounds per square foot external loading and 20 pounds per square foot internal loading pressure. Frame with integral curb double wall construction with 1" insulation, cant strips and cap flashing (roofing counter flashing), with welded or sealed mechanical corner joints. Fabricate units of the following materials:
      a. Zinc-coated steel sheets
   2. Omit insulation in pipe saddles. Provide manufacturer’s standard non-corroding pipe carriage assembly sized to suit pipes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, and with vapor barriers, roof insulation, roofing and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

B. Isolation: Where metal surfaces of units are to be installed in contact with noncompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.

C. Flange Seals: Except as otherwise indicated, set flanges of accessory units in a thick bed of roofing cement, to form a seal.

D. Cap Flashing: Where cap flashing is required as component of accessory, install to provide adequate waterproof overlap with roofing or roof flashing (as counter flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

3.2 CLEANING AND PROTECTION

Clean exposed metal and plastic surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 07 72 33

ROOF HATCH

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Roof hatches with hardware and integral curbs.

1.2 SUBMITTALS

A. Product data: Within 30 calendar days after Contractor has received Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by Architect, will become basis for accepting or rejecting actual installation procedures used on Work.

1.3 WARRANTY

Provide warranty for roof hatch system against leaks, defects in workmanship and materials, and all other defects developing under normal wear and tear. Warranty period is for 5 years after date of Substantial Completion. If any leaks occur with this period, Contractor makes repairs to system and to building (as caused by leaking), at no cost to Owner. Warranty is written in form approved by Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bilco Co.

B. Milco, Inc.

C. Equal products of other manufacturers approved in accordance with Section 01 62 00.

2.2 ROOF ACCESS HATCHES

A. Provide single leaf, thermally broken roof access hatches with following attributes:

1. Material: Cover and frame are 11-gauge (2.3 mm) aluminum.
2. Cover:: Brakeformed, hollow-metal design with 3" (75 mm) concealed polyisocyanurate insulation (R Value of 20+), 5" (100 mm) beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf (195kg/m2) live load.
3. Curb: 12" (305 mm) in height with integral capflashing, 3" (75 mm) polyisocyanurate insulation (R Value of 20+), fully welded at corners, and 5-1/2" (114 mm) mounting flange with 7/16" holes (11 mm) provided for securing frame to the roof deck.
4. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
5. Hinges: Heavy-duty pintle hinges with 3/8" (9 mm) Type 316 stainless steel hinge pins.
6. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
7. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
8. Finish: Mil finish aluminum
9. Hardware: Type 316 stainless steel hinges. All other hardware is zinc plated/chromate sealed.

10. Basis of design: Bilco Type E-50TB, or approved equal

2.3 ROOF HATCH GUARD RAILS

A. Provide roof hatch guard rail with the following attributes:

1. Basis of design: Bilco RL2-E Rail System for 36”x36” roof hatch with aluminum self-closing and latching gate, non-penetrating system attaches directly to the roof hatch cap flashing, or approved equal.

2.4 LADDER SAFETY POST

A. Provide ladder safety post with the following attributes:

1. Basis of design: Bilco LadderUp Safety Post with adjustable mounting hardware and telescoping design, or approved equal
2. Finish: Yellow powder coat paint

PART 3 - EXECUTION

3.1 INSTALLATION

Install in accordance with manufacturer's printed instruction approved for this Section. Make sure hatch is securely bolted to roof and that perimeter is completely sealed and weathertight. Adjust as necessary to put in proper working order.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sealing of penetrations at the following conditions:
   1. Fire-resistance-rated construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
   2. Smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
   3. Sealant joints in fire-resistance-rated and smoke barrier construction.
   4. Sealing of penetrations at construction assemblies to meet Code and local regulations.

1.2 REFERENCES

A. ASTM E 119 - Standard Methods of Fire Tests of Building Construction and Materials

B. ASTM E 814 - Standard Method of Fire Tests of Through-Penetration Firestops.

C. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist spread of fire, according to requirements indicated, and passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: ASTM E 814, through-penetration firestop systems with F ratings indicated, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: ASTM E 814, through-penetration firestop systems with T ratings, in addition to F ratings, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.

   T-rated assemblies are required where firestop systems are used to protect the following conditions:
   1. Penetrations located outside of wall cavities.
   2. Penetrations located outside fire-resistive shaft enclosures.
   3. Penetrations located in construction containing doors required to have a temperature-rise rating.
   4. Penetrating items larger than a 4-inch-diameter nominal pipe or 16 square inch in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: ASTM E 119 fire-resistance rating, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. Provide products that do not deteriorate when exposed to traffic, moisture, and physical damage when located in the following applications:
   1. Piping penetrations at plumbing and wet-pipe sprinkler systems, use moisture-resistant through-penetration firestop systems.
   2. Floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, use firestop systems capable of supporting the floor loads involved either by installing floor plates or by other approved materials.
   3. Insulated piping, use through-penetration firestop systems not requiring removal of insulation.

F. Firestopping Exposed to View: Follow ASTM E 84 and provide products with flame-spread values of less than 25 and smoke-developed values of less than 450.

1.4 SUBMITTALS

A. Product data for each type of product specified.

B. Product Certification: From firestopping manufacturer to indicate that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Shop Drawings: Detail materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system by product type and each penetrated construction condition. Include firestop design designation from qualified testing and inspecting agency in compliance with firestop requirements.
   1. When Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit details approved by firestopping manufacturer's fire protection engineer with modifications indicated.

D. Product Certificates: Signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Product Test Reports: Based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

F. Qualification data for firms and persons specified in article, "Quality Assurance" of this Section to demonstrate capabilities and experience. Include list of completed projects with project names, addresses, and names of Architect and Owner.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Comply with following requirements and those specified under article, "System Performance Requirements" of this Section:
   1. Firestopping tests are performed by a qualified testing and inspecting agency, UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems and are acceptable to authorities having jurisdiction.
   2. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics meeting ASTM E 119 under conditions where positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from face exposed to furnace fire.

B. Fire rated design designations of through-penetration firestop systems shown on drawings are intended to establish requirements for performance based on conditions that are expected to exist during installation. Changes in conditions and designated systems require the Architect's prior approval.

C. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.

D. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer and has the necessary experience, staff, and training to install specified manufacturer's products.

E. Single-Source Responsibility: Obtain through-penetration firestop systems for each type of penetration and construction condition indicated from a single manufacturer.

F. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

G. Coordinating Work: Coordinate construction of openings and penetrating with work of other Sections to ensure designated through-penetration firestop systems are installed to meet specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened containers and packaged intact with legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, and shelf life. Include qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturer's products that may be incorporated in this Project include, but are not limited to, the following:
   1. Ceramic-Fiber and Mastic Coating: FireMaster Bulk and FireMaster Mastic by Thermal Ceramics.
   2. Ceramic-Fiber Sealant: Metacaulk 525 by The RectorSeal Corporation.
   3. Endothermic, Latex Sealant: Fyre-Shield by Tremco Inc.
   4. Endothermic, Latex Compounds:
      a. Flame-Safe FS500/600 Series by International Protective Coatings Corp.
      b. Flame-Safe FS900/FST900 Series by International Protective Coatings Corp.
   5. Intumescent Latex Sealant:
      a. Metacaulk 950 by The RectorSeal Corporation.
      b. Fire Barrier CP 25WB Caulk by 3M Fire Protection Products.
   6. Intumescent Putty:
      a. Flame-Safe FSP1000 Putty by International Protective Coatings Corp.
      b. Fire Barrier Moldable Putty by 3M Fire Protection Products.
   7. Intumescent Wrap Strips:
      a. Dow Corning Fire Stop Intumescent Wrap Strip 2002 by Dow Corning Corp.
      b. CS2420 Intumescent Wrap by Hilti Construction Chemicals, Inc.
      c. Fire Barrier FS-195 Wrap/Strip by 3M Fire Protection Products.
   8. Job-Mixed Vinyl Compound: USG Firecode Compound by United States Gypsum Co. (USG).
   9. Mortar:
      a. K-2 Firestop Mortar by Bio Fireshield, Inc.
      b. Novasit K-10 Firestop Mortar by Bio Fireshield, Inc.
      c. KBS-Mortar Seal by International Protective Coatings Corp.
   10. Pillows/Bags:
      a. Firestop Pillow by Bio Fireshield, Inc.
      b. KBS Sealbags by International Protective Coatings Corp.
   11. Silicone Foams: Dow Corning Fire Stop Foam 2001 by Dow Corning Corp.

12. Silicone Sealants:
    a. Dow Corning Firestop Sealant 2000 by Dow Corning Corp.
    b. Dow Corning Firestop Sealant SL 2003 by Dow Corning Corp.
    c. CS240 Firestop Sealant by Hilti Construction Chemicals, Inc.
    d. Metacaulk 835 by The RectorSeal Corporation.
    e. Metacaulk 880 by The RectorSeal Corporation.
    f. Fyre-Sil by Tremco Inc.
    g. Fyre-Sil S/L by Tremco Inc.
13. Solvent-Release-Curing Intumescent Sealants:
    a. Biostop 500 Intumescent Firestop Caulk by Bio Fireshield, Inc.
    b. Fire Barrier CP 25N/S Caulk by 3M Fire Protection Products.
    c. Fire Barrier CP 25S/L Caulk by 3M Fire Protection Products.

2.2 FIRESTOPPING MATERIALS

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system required to install fill materials and to comply with article, "System Performance Requirements" of this Section. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 requirements for manufacturer's standard chemically curing, elastomeric sealants of base polymer, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Sealant Colors: Provide color of exposed joint sealants to comply with selections made by Architect from manufacturer's standard colors for products of type indicated

C. Multicomponent, Nonsag, Urethane Sealant: ASTM C 719, Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related uses under maximum cyclic movement that remain in compliance with other requirements of ASTM C 920.

D. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and uses applicable to joint substrates.

2.4 MIXING

A. Comply with firestopping manufacturer's directions for accurate proportioning of materials, liquids, type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SCOPE OF FIRESTOPPING

A. Provide firestopping as indicated on the drawings and in any opening or penetration is required to be firestopped by the building code or jurisdiction having authority, throughout the projects.

3.3 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that may interfere with adhesion of firestopping.
   2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Priming: Only prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.4 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with article, "System Performance Requirements" of this Section and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
   1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with article "System Performance Requirements" of this Section, ASTM C 1193, and with sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.6 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or damage resulting from construction operations or other damaging causes until Substantial Completion. If damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new firestopping materials to complying with requirements of this Section.

END OF SECTION

SECTION 07 92 00

JOINT SEALERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The applications for joint sealers as work of this section include the following:
   1. Pavement and sidewalk joints
   2. Concrete construction joints
   3. Floor joints (interior)
   4. Wall joints (exterior)
   5. Flashing and coping joints
   6. Interior wall/ceiling joints

1.2 GENERAL PERFORMANCE REQUIREMENTS

Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

1.3 REFERENCES

A. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

B. ASTM D 1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

C. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.

D. SWRI (Sealant, Waterproofing & Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

A. Product Data: Manufacturer's printed data indicating sealant chemical characteristics, performance criteria, limitations, and color availability for each elastomeric product required.

B. Samples: Two samples, 2 inches by 2 inches in size illustrating colors selected.

C. Certificate: Manufacturer's certificate that products meet or exceed specified requirements.

D. Warranty: Include installed sealants and accessories against failure to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or not cure

1.5 JOB CONDITIONS

A. Weather Conditions: Do not proceed with installation of liquid sealants under unfavorable weather conditions. Install elastomeric sealants when temperature is in lower third of temperature range recommended by the manufacturer for installation.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section

with a minimum of 20 continuous years of documented experience.

B. Installer: Company specializing in installation of work in this Section with a minimum 5 continuous years of documented experience and approved by sealant manufacturer.

C. Comply with Sealant and Waterproofers Institute requirements for materials and installation.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed buildings spaces without sufficient ventilation to maintain LTL solvent vapor levels.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY

A. Provide 5-year warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Manufacturers listed in this article include those known to produce the indicated category of prime joint sealer material, either as a nominally pure generic product or as an equivalent performance modification thereof or proprietary product.

B. Manufacturer:

Subject to compliance with requirements, provide products of one of the following:

1. Euclid Chemical
2. W.R. Meadows
3. Pecora Corp.
4. Sonneborn/Contech
5. Tremco, Inc.

2.2 SEALER MATERIALS

A. General Sealer Requirements: Provide colors indicated or, if not otherwise indicated, as selected by the Architect from the manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated select modulus of elasticity and hardness or grade recommended by the manufacturer for each application indicated. Where exposed to foot traffic, select non-tracking materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system.

B. Single Component Silicon Rubber Sealant: Except as otherwise indicated, provide manufacturer's standard, ultra low modulus, high performance, one part, silicone rubber based, air curing, non-sag, elastomeric sealant; complying with ASTM C920 Type S Class 25 Grade NS, FS TT-S-001543A Class A Type Non-sag. Provide Tremco "Spectrem I" or approved equal.

C. Single Component Self Leveling Polyurethane: Single component, traffic rated, pourable, semi-self leveling, gun grade, one-part moisture curing, low modulus polyurethane sealent; complying with ASTM C920, type S, grade P, class 50, use T, M, A, O, and I. Tremco “Vulkem 45SSL” or approved equal.

D. Single Component Polyurethane: Single component, gun grade, modified polyurethane sealant for exterior exposures meeting Federal Sepcification TT-S-00230C, Type II, Class A; CGSB 19-GP-13, and ASTM C920, type S, Grade NS, Class 25, Use NT, M, A, and O.

Provide Tremco "Dymonic" or approved equal.

E. Single Component Siliconized Acrylic Latex Sealant: Single component, gun grade, pure acrylic latex sealant for general purpose interior and exterior caulking and paintable meeting ASTM C-834, Tremco "Tremflex 834" or approved equal. VOC content maximum 42 grams/liter.

F. Electrical Box Seal: Sheet caulking.

2.3 PRIMERS

A. Use only nonstaining primers that have been tested for durability on surfaces to be sealed and are specifically recommended for this installation by manufacturer of sealant used.

2.4 CELLULAR/FOAM JOINT FILLERS AND SEALANT BACKERS

A. Closed Cell Synthetic Rubber Joint Filler: Provide expanded synthetic rubber complying with ASTM D1056, class SC-E of 2 to 5 psi compression deflection; except provide 13 to 17 psi compression deflection where filler is applied under sealant exposed to traffic.

B. Fiber Expansion Joint: Preformed cellular fiber complying with ASTM D1751.

2.5 BOND-PREVENTATIVE MATERIALS

A. Use only one of following as best suited for application and as recommended by sealant manufacturer
   1. Polyethylene tape, pressure-sensitive adhesive, with adhesive required only to hold tape to construction materials as indicated.

2.6 MASKING TAPE

For masking around joints, provide masking tape complying with Fed Spec UU-T-106C.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants or caulking compounds. Remove dirt, insecure coatings, moisture and other substrates which could interfere with seal of the gasket or bond of sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by the sealant manufacturer.

B. Prime or seal joint surfaces where indicated, and where recommended by the sealant manufacturer. Confine primer/sealer to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Concrete and ceramic tile surfaces:
   1. Install only on surfaces that are dry, sound, and well brushed, wiping free from dust.
   2. At open joints, remove dust by mechanically blown compressed air if required.
   3. Use solvent to remove oil and grease, wiping surfaces with clean rags.
   4. Where surfaces have been treated, remove surface treatment by sandblasting or wire brushing.
   5. Remove laitance and mortar from joint cavities.

6. Where backstop is required, insert approved backup material into joint cavity to depth needed.

D. Steel surface:
   1. Steel surfaces in contact with sealant:
      a. Clean metal surface with power tools as required to archive acceptable surface or bond.
      b. Use solvent to remove oil and grease, wiping surfaces with clean rags.
   2. Remove protective coatings on steel with power tools or by using solvent that leaves no residue.

E. Aluminum surfaces:
   1. Aluminum surfaces in contact with sealant:
      a. Remove temporary protective coatings, dirt, oil, and grease.
      b. When masking tape is used for protective cover, install tape just prior to applying sealant.
   2. Use only nonstaining solvents to remove protective cover, as recommended for that purpose by manufacturer of aluminum work.

3.3 INSTALLATION

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

B. Use only primer recommended by sealant manufacturer and approved by Architect for particular installation, applying in strict accordance with manufacturer's recommendations as approved by Architects.

C. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

D. Install sealant backer rod for liquid applied sealants, except where shown to be omitted or recommended to be omitted by the sealant manufacturer for application indicated.
   1. Use only backup material recommended by sealant manufacturer and approved by Architect for particular installation, compressing backup material 25% to 50% to achieve positive and secure fit
   2. When using backup of tube or rod stock, avoid lengthwise stretching of material. Do not twist or braid hose or rod backup stock.

E. Install bond breaker tape where indicated and where required by the manufacturer's recommendations to ensure that liquid applied sealants will perform as intended.

F. Thoroughly and completely mask joints where appearance of sealant on adjacent surfaces would be objectionable.

G. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete wetting of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

H. Install liquid applied sealant to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center section of beads.

I. Equipment:
1. Apply sealant under pressure with power-actuated or hand gun or other appropriate means.
2. Use guns with nozzle of proper size, providing sufficient pressure to completely fill joints as designed.

J. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep not less than 3/8" deep.

K. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

L. Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

3.4 SCHEDULE OF SEALANT APPLICATION

A. Exterior Doorframe perimeters and Window Frame perimeters, interior and exterior masonry joints: Single component Modified Polyurethane.

B. Exterior Concrete Sidewalk paving, Expansion Joints, Concrete expansion joints, and joints of dissimilar materials subject to pedestrian traffic: Single Component Self-Leveling Polyurethane.

C. Exterior Joints of exposed metal trim, metal gutters and downspouts: Single Component Silicon Rubber.

D. Interior Joints of dis-similar materials including trim, gypsum wallboard joints, doors and windows: Single component Silicone Acrylic Latex

E. Interior Wet Areas: One part, mildew resistant silicone rubber conforming to ASTM C920 types class 25 grade NS.

3.5 CLEANING UP

A. Remove masking tape immediately after joints have been tooled.

B. Clean Adjacent surfaces free from sealant as installation progresses, using solvent or cleaning agent sealant manufacturer recommends.

3.6 CURE AND PROTECTION

Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of standard steel doors and frames is shown and scheduled on the drawings.

1.2 QUALITY ASSURANCE

A. General:

1. Provide steel doors and frames complying with the Steel Door Institute Recommended Specifications: Standard Steel Doors and Frames (SDI-100) and as herein specified.
2. Provide standard steel doors and frames by a single firm specializing in the production of this type of work.

B. Fire Rated Assemblies: Provide fire rated doors investigated and tested as fire door assemblies, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors. Construct and install assemblies to comply with NFPA Standard No. 80, and as herein specified.

1.3 SUBMITTALS

A. Products Data: Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.

B. Shop Drawings:

1. Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of joints and connections. Show anchorage and accessory items.
2. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

C. Label Construction Certification: Submit manufacturer's certification for oversize fire rated doors and frames that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equal in all respects to new work and acceptable to the Architect; otherwise, remove and replace damaged items as directed.

B. Store doors and frames at building site under cover. Place units on wood sills at least 4" high, or otherwise store on floors in manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A568.

B. Cold Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized Steel Sheets: Hot dipped process of not less than 0.4 ounce of zinc per square foot (A40) in accordance with ASTM A924, ASTM A653.

D. Supports and Anchors: Fabricate of not less than 18 gage galvanized sheet steel.

E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

2.2 SHOP APPLIED PAINT

A. Primer: Doors and frames shall be cleaned and phosphatized with one coat of force-cured grey primer. Doors shall comply with ANSI A224.1-1990 or ASTM B117. Finishes shall pass 120 hour salt spray test and a 240 hour humidity test in compliance with ASTM D1735.

2.3 FABRICATION

A. General:
   1. Fabricate steel door and frame units to be rigid, neat in appearance and free from defect, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.
   2. Fabricate exposed faces of doors and panels from only cold rolled steel.
   3. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold rolled or hot rolled steel.
   4. Fabricate exterior doors, panels and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of inverted steel channels.
   5. Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

B. Finish Hardware Preparation:
   1. Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
   2. Reinforce doors and frames to receive surface applied hardware.
   3. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware," published by the Door and Hardware Institute.

C. Shop Painting:
   1. Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
   2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
   3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

2.4 STANDARD STEEL FRAMES

A. General:

1. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.
2. Unless otherwise noted provide (16) gauge knock down wrap around frames at all interior locations and (14) gauge galvanized welded frames for all exterior locations.
3. Anchors:
   a. Knock down frames shall be attached to structure with snap-in sill anchors and adjustable compression anchors in each jamb.
   b. Welded exterior frames shall be attached to structure with one piece welded base anchor, and a metal strap anchor for new masonry walls, or a bolt with expansion sleeve for existing masonry walls, or a universal stud anchor for frame walls.

B. Door silencers: Except on weather-stripped frames, drill stops to receive 2 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

PART 3 - EXECUTION

3.1 INSPECTION

Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify the Contractor in writing of any conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in manner acceptable to the Installer.

3.2 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.

B. Placing Frames:
1. Comply with the provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
2. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
3. Locate 3 wall anchors per jamb at hinge and strike levels.
4. Install fire rated frames in accordance with NFPA standard No. 80.
5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. Attach wall anchors to studs with tapping screws.

3.3 ADJUST AND CLEAN

A. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air drying primer.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The extent and location of each type of wood door is shown on drawings and in schedules.

B. Types of doors required include the following:
   1. Solid core flush wood doors with veneer faces

C. Factory preparation for hardware (pre-machining) for wood doors is included in this section.

D. Factory installed glazing is specified under this section.

1.2 QUALITY ASSURANCE

A. NWMA Quality Marking: Mark each wood door with NWMA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of ANSI/NWMA I.S.1 Series. For manufacturers not participating in NWMA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

B. Quality Standard: Doors to comply with ANSI/WDMA Industry Standard I.S. 1-A-13 (Window and Door Manufacturers Association).

C. Fire Rated Wood Doors: Provide wood doors with fire resistance ratings indicated or required to comply with governing regulations and which are identical in materials and type of construction to those used in assemblies which have been tested in compliance with ASTM E 152 and are labeled and listed by a testing and inspection organization acceptable to authority having jurisdiction.
   1. Fire Ratings Compliance: Fire-rated wood doors to comply with NFPA-80 requirements according to building code standards having local jurisdiction.
      a. Neutral Pressure Testing – UBC 43-2 or 7-2-94; or UL10B.
      b. Positive Pressure Testing UBC 7-2-97 or UL10C
   2. Label Certification: All doors requiring fire-rating will carry either UL or ITS (Warnock Hersey) label. Manufacturer's certification labels may be used for door size variations if approved by Authority Having Jurisdiction.

D. Manufacturer: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction, unless otherwise indicated. Company specializing in manufacturing products specified in Section with a minimum of five years documented experience.

E. Environmental Certification: All wood doors shall have environmental certification and be marked with Forest Stewardship Council (FSC) authorized certification, e.g. Smartwood approval and certificate number. Environmental certification ensures that wood components come from certified forests and are processed by chain-of custody manufacturers.

1.3 REFERENCES

Comply with the applicable requirements of the following standards unless otherwise indicated:

A. ANSI/NWMA_I.S.1, "Industry Standard for Wood Flush Doors" published by the National Woodwork Manufacturers Association.

B. AWI_Quality_Standard: Section 1300 of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute. Designations for grade and core construction under types of doors refer to this standard.

C. WDMA IS 1A – Window and Door Manufacturers Association (WDMA).

D. NFPA 80 – Fire Doors and Windows

E. NFPA 252 – Standard Methods of Fire Tests for Door Assemblies

F. Underwriters' Laboratories – UL 10B (neutral pressure) and UL 10C (positive pressure) – Fire Tests of Door Assemblies.

G. ITS (Warnock Hersey) – Certification Listings for Fire Doors

H. ASTM E90-90 – Measurement of Airborne Sound Transmission Loss of Building Partitions

I. FSC – Forest Stewardship Council guidelines for environmentally certified wood doors.

1.4 SUBMITTALS

A. Product Data:
   1. Submit door manufacturer's product data, specifications and installation instructions for each type of wood door.
   2. Include details of core and edge construction, trim for openings and louvers (if any) and similar components.
   3. Include finishing specifications for doors to receive factory applied shop finish.
   4. Include certifications as may be required to show compliance with specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements of factory finishing and other pertinent data.

C. Samples:
   1. Color samples for factory pre-finishing. Manufacturer must submit samples of not less than 4" x 6" size on representative veneer or paintable surface, with sample date indicated.
   2. Construction samples. Corner sections with door faces, edges, and core representative of the specified door type(s). Corner samples to be not less than 12" x 12".

D. Field Sample: Installed unit, complete with trim and accessories when approved by Architect, the complete mockup will establish the standard acceptable for the entire work of this Section.

1.5 WARRANTY

Specific Product Warranty: The doors shall be warranted by the manufacturer to be free of manufacturing defects for the life of the original installation. Warranty shall provide for repair or replacement of the door as originally furnished. Manufacturer shall elect to repair or replace defective door(s), and will assume reasonable costs associated with same.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the "On Site Care" recommendations of NWMA pamphlet "Care and Finishing of Wood Doors" and with manufacturer's instructions.

B. Package doors at factory prior to shipping using cartoning, or plastic wrap or paper wrap.

C. Delivery:
1. Deliver doors to site after drywall and cement are dry, and after the building has reached average prevailing humidity of its locality.
2. Deliver doors in manufacturer's original containers, clearly marked with manufacturer's name, brand name, size, thickness, and identifying symbol on the covering.
3. Seal all four edges of unfinished doors when delivered to the job site.

D. Storage:
1. Stack flat on 2 inches by 4 inches lumber, laid 12" from ends and across center.
2. Under bottom door and over top of stack, provide plywood or corrugated cardboard to protect door surfaces.
3. Store doors in area where there will be no great variations in heat, dryness, and humidity.

E. Do not drag across one another; lift doors and carry them into position.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Manufacturers are subject to evaluation and inclusion by architect/specifier. Listed below are primary manufacturers of 5 Ply – Hot Press wood doors:
1. Algoma Hardwoods Inc.
2. Mohawk Door Company
3. Eggers Industries
4. Marchfield DoorSystems
5. VT Industries, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Environmentally Certified Doors: Provide wood doors that carry a certification authorized under authority of the Forest Stewardship Council (FSC) and are certified to meet FSC requirements as pertaining to certified sourcing, content and chain-of-ownership requirements for materials used in construction of the door.

2.3 FLUSH WOOD DOORS

A. Non-Fire rated flush wood doors
1. General Grade Specification:
Refer to WDMA IS 1A for more specific grade definitions.
a. Grade Specification Required: Premium
b. Performance Standard: Heavy Duty
2. Construct using WDMA Five (5) Ply construction, using Hot Press method for laminating door materials. Stiles and rails must be securely bonded to the core and then abrasively planed prior to veneering. Door shall be “No added UREA-Formaldehyde” construction.
3. Core shall be:
A. Structural Composite Lumber Core (SCLC-5) is an engineered hardwood composite sometimes referred to as LSL (Laminated Strand Lumber). The material complies with WDMA minimum performance levels for interior applications with screw holding power of 540 lbs., modulus of rupture of 6,500 psi, modulus of elasticity of 1,300,000 psi and density of 38 lbs per cubic foot.
Core Material Specified: (Particleboard Core - PC-5), (Stave Lumber Core – SLC-5), (Structural Composite Lumber Core – (SCLC-5)

4. Crossbands shall be wood-based composites of a minimum thickness of 1/16". Crossbands and face veneers shall be laminated to the core with Type 2 interior use glue using the Hot Press process. Crossbands must extend the full width of the door. Minimum properties include internal bond of 100 psi and density of 50 lbs. per cubic foot.
5. Stiles (Vertical Edges) – Stiles shall be hardwood, one piece, laminated or veneered. Constructions with laminated edges may use structural composite lumber as an inner stile component. Stile construction shall be:
   a. Matching: Same species as face veneer.
6. Rails (Horizontal Edges) - Rails shall be solid wood or structural composite lumber meeting the minimum requirements of WDM.
7. Hardware Blocking**:**
   Provide solid wood blocking as follows: Minimum 5" Top & 5" Bottom Rail
8. Veneers:
   a. Face Grade specified: AA
   b. Veneer Cut specified: Sliced
   c. Veneer Species Specified: White Birch
   d. Veneer Match Specified: Slip
   e. Veneer Assembly specified: Running
9. Pair and Set Match - For openings with more than one door, door faces must be pair or set matched. This includes doors separated by a mullion.
   a. Matching Requirements: Matching
10. Transom and Side Panels - Fabricate matching panels with same construction, exposed surfaces, and finish specified for associated doors.
    a. Matching Requirements: Matching

B. Fire Rated Flush Wood Doors
   1. Construct fire rated doors to match non-fire rated doors, except as follows:
      a. Fire Rating Specified: Mineral Core (FD ¾, FD 1, FD 1½); as indicated on drawings.
      b. Core: Mineral core fabricated as required by manufacturer to meet Category A – Positive Pressure (concealed intumescent) finished with veneer banded edge to match face veneer.

2.4 GENERAL FABRICATION REQUIREMENTS

A. Transom and Side Panels:
   Wherever transom panels or side panels of wood are shown in same framing systems as wood doors, provide panels which match quality and appearance of associated wood doors, unless otherwise indicated. Fabricate matching panels with same construction, exposed surfaces and finish as specified for associated doors.

B. Openings:
   1. Cut and trim openings through doors and panels as shown. Comply with applicable requirements of referenced standards for kind of doors required.
   2. Light Openings: Factory cut openings. Trim openings for non-fire rated doors with solid wood moldings of same species and finish as door face. Factory install glass .
   3. Louvers: Factory cut openings and factory install metal louvers in prepared openings.

2.5 DOOR FABRICATION

A. Factory-prefit and bevel doors (3°) to suit frame sizes indicated, with 3/16" prefit in width, +/- 0 to 1/32", tolerances. Prefit top of door 1/8" +1/16"/-0", and undercut as designated by floor condition. For fire-rated doors comply with NFPA 80 for prefits and undercuts.

B. Factory pre-machine doors for hardware that is not surface applied. Locations and hole patterns to comply with specified hardware requirements as per NFPA 80 standards for doors specified; and to maintain door manufacturer's warranty
   1. Specific locations for hardware will be coordinated between frame and door manufacturers.
   2. Specific hardware preps will be per hardware schedule(s) provided. Hardware preps to be neatly and cleanly squared as required per hardware templates.
   3. Metal astragals and channels to be supplied where fire-ratings will not allow metal-free edge(s).

C. Factory Preparation for Light Openings and Louvers - Cut and trim openings through doors to comply with NFPA 80 requirements where indicated; and to maintain door manufacturer's warranty.
   1. Metal vision panels and louvers supplied primed and/or painted.

2.6 PREFITTING AND PREPARATION FOR HARDWARE

A. Prefit and premachine wood doors at factory.

B. Comply with tolerance requirements of AWI for prefitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and door frame shop drawings and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.

2.7 FACTORY FINISHING

A. Finish Location
   1. Factory Finishing – All doors (including beading and mouldings) to be finished at the factory, with UV cured system with performance properties equivalent to TR-6 or OP-6 Catalyzed Polyurethane per WDMA and System 10 per AWS. Premium grade. Factory pre-finished doors to be individually protected with either transparent or opaque (cherry, mahogany, teak, walnut) poly-wrap at the factory. Final color, build, and sheen to be approved by architect based on actual review samples.

B. Finish Type
   1. Transparent - Transparent finishes provide a clear protective coating over the wood, allowing the natural color and grain of the selected wood species to provide the appearance desired by the specifier and owner. Stain is often applied to the wood surface underneath the transparent clear finish to add more color and design flexibility.

PART 3 - EXECUTION

3.1 INSPECTION

Installer must examine door frames and verify that frames are correct type and have been installed as required for proper hanging of corresponding doors and notify Contractor in writing of conditions detrimental to proper and timely installation of wood doors. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION

A. Comply with WDMA IS 1A, door manufacturer's instruction and NFPA80 for installation of wood doors.

B. Fitting and machining: (Swing Doors)
   1. Unless doors are completely fitted and machined at the mill, fit them for width by planning and fit them for height by sawing:
      a. Bottom: 1/2" clearance maximum
      b. Top: 1/8" clearance maximum
      c. Lock edge and hinge edge: Bevel 1/8" in 2" maximum

C. Conditioning: Condition doors to average prevailing humidity in installation area prior to hanging.

D. Hardware: For installation see Division 8 "Finish Hardware" section of these specifications.

E. Manufacturer's Instructions: Install wood doors in accordance with manufacturer's instructions and as shown.

F. Fire Rated Doors: Install fire rated doors in corresponding fire rated frames in accordance with requirements of NFPA No. 80.

G. Job Fit Doors: Align doors to frame for proper fit and uniform clearance at each edge and machine for hardware. Seal cut surfaces after fitting and machining.
   1. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
   2. Bevel fire rated doors 1/8" in 2" in lock edge.

H. Prefit Doors: Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

I. Clearance:
   1. For non-rated doors provide clearances of 1/8" at jambs and heads; 1/8" at meeting stiles for pairs of doors; and 1/2" from bottom of door to top of floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
   2. For fire-rated doors, provide clearances complying with NFPA 80.

J. Shop Finished Doors: Restore finish on edges of shop finished doors before installation, if fitting or machining is required at the job site.

3.3 ADJUST AND CLEAN

A. Operation: Rehang or replace doors which do not swing or operate freely, as directed by the Architect.

B. Finished Doors: Refinish or replace doors damaged during installation, as directed by the Architect.

C. Protection and Completed Work: Advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of work.

END OF SECTION

SECTION 08 16 13

FIBERGLASS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

This section includes the design and performance specifications for fiberglass reinforced polyester doors, aluminum frames, and fiberglass reinforced architectural panels.

1.2 QUALITY ASSURANCE

A. Qualifications: Provide door assemblies designed and fabricated to comply with requirements for system performance characteristics listed below:
   1. Thermal Transmittance: U-value of not more than 0.087 nominal BTU/per AAMA 1503.1

B. Manufacturer Qualifications: Shall have produced fiberglass reinforced polyester doors featuring non-welded tie-rod construction for a minimum of ten (10) years. Shall have completed projects of similar building type and size. Manufacturers failing to meet the above requirements will not be accepted.

1.3 SPECIAL PROJECT WARRANTY

A. Material and workmanship of doors and frames shall be guaranteed to be free of defects for ten (10) years from the date of installation.

B. Only authorized factory personnel shall make any field modifications to the manufacturer's hardware, other than that which the door was engineered to receive.

C. The hardware manufacturer will guarantee hardware provided and installed by the door manufacturer for their applicable time span with installation being as covered above. A written copy of the manufacturer's warranty shall be supplied to the Owner.

1.4 PERFORMANCE REQUIREMENTS

A. Structural: When door corner is tested for strength in accordance with Dual Moment Load Test, top door corner test section shall withstand load of 190 pounds on lever arm before reaching point of failure. Failure is rotation of lever arm in excess of 45 degrees.

1.5 SUBMITTALS

A. Product Data:
   1. Materials list of items proposed to be provided under this Section;
   2. Manufacturer's specifications and other data needed to prove compliance with specified requirements;
   3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of work of this Section with work of adjacent trades;

B. Samples: Samples of finishes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER- FIBERGLASS DOORS

A. Manufacturer: Subject to compliance with requirements, provide products of the following: SL-17 with SpecLite3 as manufactured by Special-Lite, Inc., Decatur, Michigan, or approved equal.

2.2 MATERIALS AND ACCESSORIES

A. Aluminum Members: Alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate with aluminum wall thickness of 0.125".

B. Components: Furnish door and frame components from the same manufacturer. "Splitting" of door and frame components is not permitted.

C. Fasteners: Aluminum, non-magnetic stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened. For exposed fasteners (if any) provide Philips head screws with finish matching the item to be fastened.

2.3 FABRICATION

A. Sizes and Profiles: The required sizes for door and frame units, and profile requirements determined by field measurement. See drawing for door locations.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on final shop drawings.

C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to assembly. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".

D. No welding of doors or frames is acceptable.

E. Maintain continuity of line and accurate relation of planes and angles. Secure attachments and support at mechanical joints, with hairline fit at contacting members.

2.4 FIBERGLASS REINFORCED POLYESTER FLUSH DOORS

A. Materials and Construction.

1. Construct 1- 3/4" thick doors of 6063-T5 aluminum alloy rails and stiles minimum 2-5/16 " depth. Construct with mitered corners and provide joinery of 3/8" diameter full width tie rods through extruded splines top and bottom as standard. .125" tubular shaped stiles and rails reinforced to accept hardware as specified. Provide hex type aircraft nuts for joinery without welds, glues or other methods for securing internal door extrusions. Furnish integral reglets to accept face sheet to permit a flush appearance. Rail caps or other face sheet capture methods are not acceptable.
2. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum rails and stiles.
3. Door face sheeting .120" thickness fiberglass reinforced polyester, SL-17 doors with an abuse resistant engineered surface of the standard colors as selected by Architect.
4. Core of Door Assembly: Minimum five (5) pounds per cubic foot density poured-in-place polyurethane free of CFC. Minimum "R" value of 11. Meeting stiles on pairs of doors and bottom weather bars with nylon brush weather-stripping.
5. Pre-machine doors in accordance with templates from the specified hardware manufacturers and approved hardware schedule. Factory install hardware.

2.5 ALUMINUM FRAMING SYSTEMS

A. Thermally Broken Tubular Framing
   1. Framing system from the door manufacturer of the size and type shown. .125" minimum wall thickness and type 6063-T5 aluminum alloy. .625" high applied door stops with screws and weather-stripping. Frame members are to be box type with four (4) enclosed sides. Open back framing will not be acceptable.
   2. Caulk joints before assembling frame members. Secure joints with fasteners and provide a hairline butt joint appearance. Pre-fit doors to frame assembly and factory prior to shipment. Field fabrication of framing using "stick" material is not acceptable.
   3. Applied stops for side, transom and borrowed lites and panels, with fasteners exposed on interior or unsecured portion only. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and the approved hardware schedule. Factory install hardware.
   4. Install with anchors appropriate for wall conditions to anchor framing to wall materials. A minimum of five anchors up to 7'4" on jamb members and one additional anchor for each foot over 7'4". Secure head and sill members of transom, sidelites and similar conditions.
   5. Factory pre-assemble sidelites to the greatest extent possible, and mark frame assemblies according to location.

2.7 FIBERGLASS REINFORCED ARCHITECTURAL PANELS
A. Manufacturer: Subject to compliance with requirements, provide products of the following: SL-37 pebble grain FRP architectural panels as manufactured by Special-Lite, Inc., Decatur, Michigan.
B. Material: Standard exterior and interior face, Class C 0.120” thick, pebble texture, through color with SpecLite3 integral surfaseal film FRP sheet.
C. Performance:
   1. 1” thick panels with closed-cell polyurethane foam core bonded between outer skins
   2. Impervious to water
   3. Thermal performance, AAMA 1503-98
      a. U-Factor= 0.23 Btu/hr-ft^2 degrees F
      b. CRFp= 81

2.8 FINISHES
A. All aluminum to be provided in anodized finishes complying with Aluminum Association standards AAM12C22A31.
   1. Door face panels shall be embossed surface with Fluropon finish, factory applied in color Architect selects.

B. All exposed surfaces of aluminum door and framing members shall be free of scratches and other serious surface blemishes.

2.9 HARDWARE
A. General:
   1. All doors and frames shall be machined using templates available from the manufacturer of specified hardware. Doors and frames shall be internally reinforced for specified surface hardware. All doors to be properly reinforced for hardware before core is foamed.
   2. Doors are to be shipped with hardware installed except for door closer and holders, locksets and thresholds that may be field applied.

2.10 ACCESSORIES
A. Vision Lites
   1. Model: All fiberglass

2. Glazing thickness: 1” insulated tempered glass
3. Size: See drawings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

B. Commencement of work shall signify acceptance of conditions and any subsequent adjustments shall be the responsibility of the Contractor.

C. Field inspection and measurement of doorframes and doors is the responsibility of the Contractor. Any problems in installing units shall be the responsibility of the Contractor, who shall bear all additional expense to meet full satisfaction of the Owner.

3.2 FIELD QUALITY CONTROL

A. Inspection: test door and frame for proper fit and smooth operation and confirm that no damage occurred during installation.

3.3 INSTALLATION

A. Install work of this Section in strict compliance with original design, approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and manufacturer’s recommended installation procedures, anchoring all components firmly into position for long life.

B. Remove protective coating completely from exposed surfaces as soon as progress of Work will safely permit.

3.4 ADJUSTING AND CLEANING

A. Upon completion of installation, leave work areas and materials installed in a neat and clean condition.

B. Upon completion of installation, lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion and fitting weather-tight for the entire perimeter.

3.5 PROTECTION

A. Secure area. Provide proper protection of completed entrance system from damage or physical abuse until final inspection and approval of owner.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Panels installed in ceilings, floors and walls as required to provide access to items concealed behind finish surfaces.

B. The extent, location, and size of each type of access door required shall be determined by the final locations of all equipment and devices.

C. The Contractor shall provide access panels to all concealed equipment, mechanical devices, plumbing fittings, and any building component required to be accessed for maintenance or operational functions. Access panels shall be sufficient size to provide the necessary access.

1.2 QUALITY ASSURANCE

A. Fire Resistance Ratings:
   1. Wherever a fire resistance classification is required, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.; "Classified Building Materials Index" for rating shown.
   2. Provide UL label on each fire rated access door.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly.

C. Coordination: Furnish inserts and anchoring devices which must be built into other work for installation of access doors.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

B. Shop Drawings: Submit shop drawings for fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.

B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction using commercial quality, cold formed steel sheets, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

2.3 ACCESS PANELS

A. Fire-Rated –not insulated-(interior walls only)
   1. Material: 16-gauge steel frame with 14-gauge door panel
   2. Type: Standard access panel with 1” flange perimeter for installation in all wall surfaces.

3. Hinge: flush continuous piano hinge
4. Lock: knurled knob with flush key operated latch bolt.
5. Size: smallest size practical to provide necessary access as approved by Architect
6. Finish: phosphate dipped and factory applied prime coated
7. Fire Rating: compatible with wall rating, and labeled with certification
8. Automatic closure: integral automatic spring closure device.
9. Product: Style "UT" flush fire rated Standard panel as manufactured by Nystrom Building Products or approved equal.

B. Fire-Rated –insulated-(ceilings and exterior walls)
1. Material: 16-gauge steel frame with 20-gauge insulated sandwich construction door panel
2. Type: Standard access panel with 1” flange perimeter for installation in all wall and ceiling surfaces.
3. Hinge: flush continuous piano hinge
4. Lock: knurled knob with flush key operated latch bolt.
5. Size: smallest size practical to provide necessary access as approved by Architect
6. Finish: phosphate dipped and factory applied prime coated
7. Fire Rating: compatible with wall rating, and labeled with certification
8. Insulation: 2 inch thick fire rated mineral fiber
9. Automatic closure: integral automatic spring closure device.
10. Product: Style "IT" flush fire rated Standard panel as manufactured by Nystrom Building Products or approved equal.

C. Non-Rated
1. Material: 16-gauge steel frame with 14-gauge door panel.
2. Type: Standard access panel with exposed 1” flange perimeter for mounting in all types of wall surfaces.
3. Hinge: concealed pin type, spring loaded to allow for door removal, set to open to 175 degree swing.
4. Lock: screw driver operated cam
5. Size: smallest size practical to provide necessary access as approved by Architect
6. Finish: phosphate dipped and factory applied prime coated
7. Product: Style "NT" flush non-rated Standard panel as manufactured by Nystrom Building Products or approved equal.

D. Security: Provide in areas accessible by the public
1. Material: 12-gauge steel frame with 12-gauge door panel.
2. Type: Standard access panel with exposed 1” flange perimeter for mounting in all types of wall surfaces.
3. Hinge: Concealed, continuous piano
4. Lock: flush key operated latch bolt
5. Size: smallest size practical to provide necessary access as approved by Architect
6. Finish: phosphate dipped and factory applied prime coated
7. Product: Style ‘MT’ flush standard panel as manufactured by Nystrom Building Products or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions for installation of access doors.

B. Coordinate installation with work of other trades.

C. Set frames accurately in position securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

D. Position units to provide convenient access to concealed work requiring access.

3.2 ADJUST AND CLEAN

Adjust hardware and panels after installation for proper operation. Remove and replace panels or frames which warped, bowed or otherwise damaged.

END OF SECTION

SECTION 08 33 32

ROLLING COUNTER DOORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK
The size and location of rolling counter doors is indicated on the drawings.

1.2 SUBMITTALS
A. Product Literature:
1. Information indicating operation, materials, finishes, balance mechanism, hardware and accessories provided.
2. Provide manufacturer's standard color charts for selection of finishes.

B. Shop Drawings: Information showing construction, mounting angles, guides, locking, operating mechanism, clearances required and mounting templates.

1.3 REFERENCES
A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

G. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 DESIGN / PERFORMANCE REQUIREMENTS
A. Rolling Counter Doors:
1. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

A, 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. Details of construction and fabrication.
4. Installation instructions.

B. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 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 absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Warranty: Manufacturer’s limited door warranty for 2 years for all parts and components.

B. PowderGuard Premium Finish applied to curtain, guides, bottom bar, headplates: Manufacturer’s limited Premium Finish warranty for 2 years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with other requirements, provide products of one of the following:
   1. Crawford Door Co.

2. Overhead Door Co.
3. Cookson Company

2.2 ROLLING COUNTER DOORS

A. Anodized Aluminum Counter Doors: Overhead Door Corporation, 655 Series

1. Curtain Material: .040” aluminum
   a. Slats: Integral frame and sill slats, 1-1/2” profile, flat
   b. Endlocks: Stamped, hot-dip, galvanized endlocks riveted to each end of alternate slats to prevent lateral movement and limit slat deflection and bending stress,
2. Finish:
   a. Anodized Finish
      ii. Powder Coat:
         a. PowderGuard Preminum powder coating finish in color as selected by Architect from manufacturer’s standard colors.
3. Bottom Bar:
   a. 6063-T6 aluminum, clear anodized
4. Brackets: Steel plate to support counterbalance, curtain and hood.
5. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel.
6. Hood: Provide with intermediate support brackets as required and fabricated of aluminum.
7. Integral Frame: 16 gauge, 300 series stainless steel, with guides incorporated into jamb design, reinforced by 12 gauge mounting structure.
8. Sill: Manufacturer’s standard 14 gauge stainless steel
9. Manual Operation:
   a. Manual push up
10. Locking:
    a. Interior slide bolt locks suitable for use with padlock.
11. Wall Mounting Condition:
    a. Between jamb mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. 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.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install perimeter trim and closures.

F. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

G. Assemble frames and balance mechanism, anchor to wall as shown and to meet manufacturer's recommendations.

H. Installation shall be performed by manufacturer or contractor licensed by the manufacturer.

I. Put in good working order. Demonstrate that door operates properly.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies as necessary for smooth, gradual, and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

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

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 41 13

ALUMINUM FRAMED ENTRANCES & STOREFRONT

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum Storefront, including:
   1. YKK AP Series 50T Thermally Broken Wide Stile Swing Entrances.
   2. YKK AP Series 45TU Center Set Thermally Broken Commercial Storefront System

1.2 SYSTEM PERFORMANCE DESCRIPTION

A. Performance Requirements: Provide aluminum swing doors that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test methods indicated.
   1. Air Infiltration (Single Acting Butt Hinges or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283-91 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed the following 0.50 CFM/FT² for single door or 1.00 CFM/FT² for pair doors
   2. Structural: Door corner structural strength shall be tested per YKK AP's dual moment test procedure and certified by an independent testing laboratory to ensure corner integrity and weld compliance. Certified test procedures and results are available upon request.
   3. Uniform Load Test: For 50T Single Doors: ±50 psf.
   4. Thermal Performance:
      a. When tested in accordance with AAMA 1503 and AAMA 507 based on Standard 1" insulating unit:
      b. Condensation Resistance Factor (CRFf): A minimum of 59.
      c. Thermal Transmittance U-Value: 0.52 BTU/HR/FT²/°F.
   5. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 90, AAMA 1801:
      a. Sound Transmission Class (STC) shall not be less than: 1" IGU; 29, laminated; 30.
      b. Outdoor–Indoor Transmission Class (OITC) shall not be less than: 1" IGU; 25, 1" laminated; 27.
   6. Forced Entry Resistance: 300 lbs. satisfactory.

1.3 PROJECT CONDITIONS/SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.4 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

B. Product Data: Submit product data for each type storefront series specified.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.

D. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.

E. Quality Assurance / Control Submittals:
   1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Installer Qualification Data: Submit installer qualification data.

F. Closeout Submittals:
   1. Warranty: Submit warranty documents specified herein.
   2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.
      a. Maintenance Data: Maintenance procedures for care and cleaning of entrance systems.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.

B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.6 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
   1. Warranty Period: Manufacturer’s one (2) year warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment by YKK AP America Inc.

PART 2 – PRODUCTS

2.1 Manufacturers (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc., 270 Riverside Parkway, Suite 100, Austell, GA 30168, Telephone: (678) 838-6000; Fax: (678) 838-6001
   1. Storefront System: YKK AP YES 45 TU Front Set Storefront System, or approved equal
      a. Description: Front set, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery or shear block attachment.
      b. Components: Manufacturer's standard extruded aluminum mullions, 90 degree corner posts, entrance door framing, and indicated shapes.
      c. Thermal Barrier: Provide continuous thermal barrier by means of a poured and debridged pocket consisting of a two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK ThermaBond Plus®. Systems employing non-structural thermal barriers are not acceptable.
   2. Wide Stile Swing Doors: YKK AP Series 50T Thermally Broken Wide Stile Swing Door, or approved equal
      a. Description: 2” thick by 5" (127.0 mm) Door Stile
      b. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws and sigma deep penetration welding.

c. Glazing Stops: Manufacturer's standard snap-in glazing stops with EPDM glazing gaskets to prevent water infiltration.
d. Weather-stripping: Manufacturer's standard pile type in replaceable rabbets for stiles; manufacturer's standard EPDM bulb type in door frames.
e. Hardware: Manufacturer's standard as selected by Architect.

2.2 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

2.3 ACCESSORIES

A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
2. Sealant: Non-skinning type, AAMA 803.3.
3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.
4. 0.050 Aluminum Sill Flashing End Dams must have 3-point attachment.
5. Partition Closure: Mullion Mate Series 30 Extruded Aluminum Partition Gap Closures with end cap in standard satin clear anodized factory finish by Gordon Architectural + Engineered Solutions, or approved equal.

2.4 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.5 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YS1N*	Clear Anodized Plus®

Anodized Plus® is an advanced sealing technology that completely seals the anodic film yielding superior durability (See AAMA 612).

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
a. Exposed Surfaces shall be free of scratches and other serious blemishes.
b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.

c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

2. CASS Corrosion Resistance Test, CASS 240/ASTM B368 Test Method.
3. Other AAMA 2605 Performance Tests specified in these specifications, such as: 7.3 Dry Film Hardness; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.

C. Finishes Testing:
1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest installation manual is available at www.ykkap.com.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.3 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.4 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
2. Shim and brace aluminum system before anchoring to structure.
3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior. Verify metal joints are sealed in accordance with manufacturers installation instructions.
5. Locate expansion mullions where indicated on reviewed shop drawings.
6. Seal metal to metal storefront system joints using sealant recommended by system manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Field Test: Conduct field test to determine water tightness of storefront system. Conduct test in accordance with AAMA 501.2.

3.6 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance and remove construction debris from project site. Legally dispose of debris.

C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 08 44 14

ALUMINUM SUN SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum Sun Shades:
   1. YKK AP Series ThermaShade® Aluminum Sun Shade System, or approved equal

B. Related Sections:
   1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
   2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
   3. Single Source Requirement: All products listed below shall be by the same manufacturer.
      a. Section 08 41 13 Aluminum-Framed Entrances and Storefronts.

1.2 SUBMITTALS

A. Product Data: Submit product data for each type sunshade and curtain wall series specified.

B. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during Construction process.

B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
   1. Mock-Up Size: Full scale
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.4 PROJECT CONDITIONS / SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction

delays.

1.5 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.

1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project.

PART 2 – PRODUCTS

2.1 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers: YKK AP America Inc., 270 Riverside Drive, Suite 100, Austell, GA 30168. Telephone: (678) 838-6000; Fax: (678) 838-6001

1. Curtain Wall System: YKK AP ThermaShade® Aluminum Sun Shade System.

B. Sun Shade System:

1. Description: All structural components and attachment hardware shall be concealed.
2. Thermally improved anchor: Sunshade anchor must provide a continuous thermal barrier by means of a poured and debridged pocket consisting of a two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK AP ThermaBond Plus™. Anchors employing non-structural thermal barriers are not acceptable.
3. Outrigger: Rounded outrigger
4. Louvers: 3" Circle
5. Fascia: 3" Circle
6. Depth: 30"
7. Anchors: Concealed

2.2 MATERIALS

A. Extrusions: ASTM B 221, 6063-T5 and 6063-T6 Aluminum Alloys.

B. Aluminum Plate: Painted Finish: ASTM B 209, 3003-H14 Aluminum Alloy, 0.25" nominal thickness.

2.3 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: AISI 300 series stainless steel fasteners.

2.4 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secured, in accordance with manufacturer's recommendations.

2.5 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:
CODE DESCRIPTION
YS1N* Clear Anodized Plus®

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality-controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition

process.

c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.

d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.3 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.4 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
2. Shim and brace aluminum system before anchoring to structure.
3. Verify curtain wall system allows water entering system to be collected in gutters and wept to the exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions.
4. Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

3.6 ADJUSTING AND CLEANING

A. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance and remove construction debris from project site. Legally dispose of debris.

B. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 08 70 00

HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: All finishing hardware not factory installed, including miscellaneous items required for complete installation of specified items.

1.2 QUALITY ASSURANCE

A. Supplier of finish hardware must meet following conditions for Architect's approval:
   1. Be recognized distributor of lock manufacturer.
   2. Sufficiently experienced organization and trained hardware consultants to properly specify, detail, and service finishing hardware in satisfactory manner.
   3. At all times, stocks representative inventory of specified finishing hardware in order to take care of shortages and minor extras without delay.
   4. Qualified member of the organization is readily available to General Contractor on jobsite within 48 hours notice, until job is complete.

B. Guarantee: In addition to guarantee contained in General Conditions, guarantee all material free from defects for period of two (2) years after Substantial Completion. Material found to be defective shall be removed and replaced including labor at no expense to Owner.

1.3 SUBMITTALS

A. Completely detailed hardware schedule. Schedule shall include following information:
   1. Architect's Opening Number
   2. Location
   3. Size of Opening
   4. Manufacturer's Number
   5. Finish
   6. Keying
   7. UL Label, if applicable
   8. All other pertinent data

B. Do not proceed until Architect has reviewed hardware schedule and Owner has approved keying.
   1. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

C. Deviation from or modification of items will be permitted only for special instances, caused by reason of construction characteristics and for purpose of providing proper operational function.

D. Prior to final acceptance, certify that hardware in place is same as that called for on final hardware schedule or on approved modification thereof.

E. Templates: Issue, free of charge, to all interested parties, hardware schedule and template drawings required for preparation of doors and frames.

1.4 PRODUCT HANDLING AND STORAGE

A. Each item of hardware shall be substantially packed in approved manufacturer's container, complete with trimmings, bolts, and other fasteners required for application. Each package shall be clearly labeled with manufacturer's number, quantity included, and schedule identification number.

B. Deliver hardware in time to not delay project. Deliver, as directed, to jobsite.

C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control and handling and installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation.

1.5 CODE CONFORMANCE

A. Finish hardware shall conform with all applicable codes and regulations, including requirements of:
   1. ANSI 4.13.9
   2. NFPA 80 - Fire Doors and Windows.
   3. NFPA 101 - Life Safety Code.
   4. Local and state building codes.
   5. UL Labeled for Rated Doors.
   6. DHI - Door and Hardware Institute.
   7. SDI - Steel Door Institute.
   8. AWI - Architectural Woodwork Institute.

1.6 FIRE-RATED OPENINGS

A. Where doors are indicated as labeled assemblies, provide only hardware that has been tested and listed by UL for the type, sizes and labels of doors and frames shown or otherwise required by local code, in compliance with American Insurance Association, Pamphlet No. 80 and NFPA, Standard No. 80, current editions. This requirement takes precedence over other requirements for such hardware specified.

1.7 JOB CONDITIONS

A. Coordination: Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper locations for installation.

B. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of hardware. The Contractor shall check the shop drawings of such other work, to confirm that adequate provisions are made for the proper installation of hardware.

PART 2 - PRODUCTS

2.1 FINISH HARDWARE

A. Manufacturer:
   1. Products of finish hardware supplied shall be selected from manufacturers mentioned in this document.
   2. Hardware specified herein shall be considered as standard of quality.

2.2 MATERIALS AND FABRICATION

A. Hand of door: The drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown.

B. Manufacturer's Name Plate: Do not use manufacturer's products that have manufacturer's name or trade name displayed in a visible location, except in conjunction with required UL

labels and as otherwise acceptable to the Architect.

C. Base Metals: Produce hardware units of the basic metal and forming method indicated, using the manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser quality than specified for the applicable hardware units by FS FF-H-106, FS FF-G-111, FS FF-H-116 and FS FF-H-121. Do not furnish optional materials or forming methods for those indicated, except as otherwise specified.

D. Fasteners:
1. Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screw, except as specifically indicated.
2. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work.

E. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, and removal and replacement of builder’s hardware.

2.3 HINGES AND BUTTS

A. Template: Provide template produced units only.

B. Hinge Pins:
Except as otherwise indicated, provide hinge pins as follows:

1.	Steel Hinges:	Steel pins.
2.	Non-Ferrous Hinges:	Stainless Steel Pins
3.	Exterior Doors:	Non-removable pins.
4.	Out-Swing Corridor Doors:	Non-rising pins.

Tips: Flat button and matching plug, finished to match leaves, except where hospital tip indicated.

C. Size: Provide 4 1/2" x 4 1/2" hinges on doors up to 3'0" in width. Provide 5" x 4 1/2" hinges on doors from 3'2" to 4'0" in width.

D. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

E. Screws: Provide manufacturers' standard screws.

2.4 LOCK CYLINDERS AND KEYING

A. General:
1. Supplier will meet with the Owner to finalize keying requirements and obtain final instructions in writing.
2. Comply with the Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

B. Standard System:

1. Existing System: Provide keying system integrated with the Owner's existing key system, with a new master key for the project.

C. Metals: Construct lock cylinder parts from brass, bronze, stainless steel or nickel silver.

D. Keys:
1. Provide keys of nickel silver only.
2. Provide 3 change keys for each lock; 5 master keys for each master system; and 5 grandmaster keys for each grandmaster system.

E. All cylinders shall be BEST key system, keyed into the existing factory registered Grand Masterkey System with a restricted keyway.

F. Cylinder and core to be supplied by the same manufacturer.
1. Permanent cylinders, temporary brass cores and permanent cores shall be supplied and installed by the contractor. All doors shall have temporary brass cores to allow securing of all areas as needed during construction.
2. Permanent cores will be shipped to owner for installation by contractor. Installation is to be scheduled one week prior to substantial completion.

G. Compatibility: It is the finish hardware supplier’s responsibility to assure compatibility between the locksets and cylinders when components of different manufacturers are used. Correct collars and cams must be provided and work properly.

H. Key Management: Key control shall be provided by supplying a complete key storage and management system. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the key cabinet supplier and shipped with the locks. Key cabinet provided shall be wall mounted (by contractor) type with capacity plus 50%. Provide 3-way cross index system referencing the 1) permanent room number; 2) key symbol; 3) bitting number set up by key control manufacturer and place keys on markers and hooks in the cabinet as determined by the final key schedule. Identify each key. Provide a red tag for each key and mark this tag "DO NOT REMOVE". Attach to one (each differently numbered) key and place it first in the key cabinet. Using white tags place the remaining 4 like keys on the same hook. Provide 4 copies of chart showing hook number, key number, the location or room the key opens and the key cut. One chart to be a permanent part of the key cabinet. Turn over the other 3 to owner's locksmith. Provide and install hinged-panel wall mount type cabinet. Provide key cabinet by MMF Industries.

I. Deliver permanent keys to the Owner's representative and locksmith upon acceptance of the building. At this time the contractor will replace the construction system and core with permanent keys and cores in the presence of the owner. All keys and locks shall be tested and approved by the owner before acceptance.

2.6 LOCKS AND LATCHES

A. Locks: All locks shall be heavy duty key-in-levers, U/L labeled for use on fire doors up to and including 3 hours. Levers shall be cast with 3 1/8" diameter cold forged roses. Lever locksets shall have independent lever return springs and free wheeling lever handles when unit is locked. Also provide tru-bolts and mounting plate for chassis stability. Lockset series must be BEST keying system, compatible with owner’s existing keying system.

B. Strikes:
1. Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
2. Provide dust proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

2.7 SURFACE CLOSERS

A. Type: All surface closers shall be full rack and pinion type with cast aluminum alloy or cast iron shell. Closers shall be full metal cover type and shall project no more than 2 1/4" from the mounting surface. Closers shall be non-handed and be provided with non-gumming and non-freezing hydraulic fluid. Closers shall have two non-critical valves, hex-key adjusted to independently regulate closing and latch speed. Closers shall also have multi-size spring power adjustment to permit setting of power from size 2 thru 6.

B. Access-Free Manual Closers: Where manual closers are indicated for doors provide adjustable units complying with ANSI A 117.1 provisions for door opening force and delayed action closing.

C. All closers are to be supplied and installed with sex, nuts and bolts.

2.8 PROTECTIVE PLATES

A. Armor Plates: Armor plates shall be 24" tall by 2" less than door width. On labeled doors the armor plates shall be a maximum of 16" in height. Plates shall be stainless steel and beveled on three sides.

2.9 THRESHOLDS

A. Supply thresholds as indicated in the drawings or in the hardware sets. All thresholds shall conform to state and local handicap codes.

2.10 WEATHERSTRIPPING, GASKETING AND SILENCERS

A. All exterior openings and all interior smoke and fire openings shall be gasketed with UL labeled and listed Ultra WS108 or equal. Apply gasketing to head jamb, hinge jamb, lock jamb and astragal. For other applications, refer to drawings and hardware sets.

B. Silencers: Provide silencers for all hollow metal frames, 3 at each single door and two at each pair of doors.

PART 3 - EXECUTION

3.1 HARDWARE INSTALLATION

A. General: Prior to installing any hardware the supplier will meet with the owner, manufacturers representatives and the installer to review installers qualifications, installation, templates, tools, etc. Installer must have ten years minimum experience commercial/ institutional hardware installing. Install each hardware item in compliance with manufacturers instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, reinstall each item. Do not install surface mounted items until finishes have been completed in the substrate. Protect hardware from damage until Final Acceptance.

B. Hardware mounting heights shall comply with DHI "Recommended Locations for Builders Hardware" as scheduled below: Except as specifically indicated or required to comply with governing regulations and except as may be otherwise specified by the architect.
   1. Center of doorknobs: 38" above finished floor.
   2. Center of cylinder deadlocks: 48" above finished floor.
   3. Center of panic bars: Per manufacturers instructions.
   4. Center of push plates: 45" above finished floor.
   5. Upper edge of top hinge: 5" below door head

6. Lower edge of bottom hinge: 10" above finished floor.
7. Center hinge: Midway between top and bottom hinge.

C. Adjust and check each operating item of hardware and each door, to ensure proper operation of functions of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricate to operate freely and smoothly as intended for the application made. All installation tools furnished with hardware shall be turned over to owner at completion of project.

D. Thresholds shall be full width of openings, notch at stops and center mullions, if required, and set in full bed of butyl rubber or polyisobutylene mastic sealant in accordance with manufacturers instructions such as to prevent seepage of water or vapor.

E. Installation by other trades: All electric equipment is to be coordinated with responsible trade, with proper wire and wiring furnished and connections made under that section.

F. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance of occupancy, make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Replace all defective, damaged, missing or stolen hardware.

G. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

H. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

I. Clean adjacent surfaces soiled by hardware installation.

3.2 FASTENERS

A. Fasteners shall be suitable size, quantity and of the same material and finishes of hardware, unless otherwise specified to secure hardware on proper position. All fasteners exposed to weather shall be nonferrous or corrosion resisting steel.
   1. Machine screws and tapcon shields shall be furnished for attaching hardware to concrete, stone or masonry.
   2. Machine or sheet metal screws shall be furnished for attaching hardware to metal.
   3. Self tapping screws shall be furnished for attaching kickplates to mineral core doors.
   4. Full thread screws shall be furnished for attaching butt hinges to wood core doors.
   5. Sex bolts shall be provided for attaching surface type closers or closer arm to wood doors.
   6. Use only machine screw expansion shields when fastening into masonry. Do not use plastic anchors.
   7. Where tamperproof screws are specified, provide special security type torx screws with tamperproof center pin.

3.3 MATERIALS AND WORKMANSHIP

A. Provide all hardware, unless otherwise specified, of the best grade, entirely free of imperfections in manufacture and finish, and guaranteed by the manufacturer to satisfactorily perform the various functions required of it for a long life under normal usage. Metal finishes will be as specified.

B. Continued Maintenance: Approximately six months after the acceptance of hardware in each area, the installer, accompanied by the representative of the latch and lock manufacturer, shall

return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Instruct owner's personnel in proper adjustment and maintenance of hardware and hardware finishes.

C. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems in the performance of the hardware. Provide owner manufacturers manuals for all hardware.

3.4 COORDINATION

A. The hardware supplier shall consult the project drawing and details and otherwise familiarize himself with work to the end that all items of hardware furnished shall conform to units to which it is applied. He shall coordinate the hardware with other conflicting trades such as millwork metal doors and frames, etc.

B. Immediately after the award of the hardware purchase order, it shall be the duty of the hardware supplier to request approved shop drawings from such trades with which the hardware must be coordinated.

C. After checking approved shop drawings, hardware supplier shall supply promptly such template information, template drawings, approved hardware schedules, etc., as may be required to facilitate the progress of the job.

D. Prior to Owner's acceptance of the building, the hardware supplier shall walk the job to assure all hardware is properly installed and adjusted according to manufacturer's installation instructions.

3.5 HARDWARE DATA

A. Following hardware descriptions correspond to hardware sets on the drawings. Equip doors leading to dangerous areas such as switch rooms, mechanical rooms, and electrical closets with levers that have been knurled.

1. Hinges
   a. High Frequency Full Mortise: 5-Knuckle, four ball bearing assembly, heavy weight full mortise hinge, 4-1/2” x 4-1/2” with NRP. US 26D satin chrome finish on steel base for interior doors, US 32D satin stainless finish on stainless steel base for exterior doors. Ives Model 5BB1HW or approved equal.
   b. Medium Frequency Full Mortise: 5-Knuckle, two ball bearing assembly, medium weight, full mortise hinge, 4-1/2” x 4-1/2”. US 26D satin chrome finish on steel base. Ives Model 5BB1 or approved equal.
   c. Continuous Geared Hinge: Full mortise geared hinges certified to ANSI 156.26, Grade 1, UL approved to 90 minutes, fabricated from 6063-T6 aluminum, US 28 clear anodized finish. Ives Model XY or approved equal, continuous hinge full height of door.

2. Exit Devices:
   a. Rim Exit Device with Lever Trim Night Latch function: Rim type exit device for wide stile doors, fire rated where indicated, size 3 for doors up to 3’-0” wide, size 4 for doors greater than 3’ wide, hardware configured to accommodate various door and frame materials and conditions, left or right hand as required, with fail secure, storeroom function, Von Duprin 35A series with US 26D finish and #17 standard lever.
3. Full Mortise Locksets and Latchsets:
   a. Non-Electric Full Mortise Lever Locksets: Grade 1, full mortise lockset with full height escutcheon, Corbin Russwin ML2000 series with type ‘M’ escutcheon and ‘NS’ Newport standard lever, all US 26D finish.

i. Classroom Function: Corbin Russwin Model ML2055 (F05)
ii. Storeroom Function: Corbin Russwin Model ML2057 (F07)
iii. Office Function: Corbin Russwin Model ML2054 (F04)
iv. Privacy: Corbin Russwin Model ML2060 (F22) Indicator Series with vacant/occupied indicator

4. Manual Door Closers: Heavy duty, Grade 1, UL listed for fire doors, 30-year warranty, incorporating ADA reduced force requirements, meets 'Buy America Act' compliant, LCN 4040X series, 'HEDA' parallel arm, and metal cover with powder coat finish.
5. Door Accessories:
   a. Threshold: Pemko extruded aluminum ½" tall, depth equal to full depth of door jamb or approved equal.
   b. Weather Strip Set: (Head and Jambs) Pemko Model 296-S standard extruded aluminum with silicone insert mill aluminum finish or approved equal.
   c. Door Sweep: Pemko Model 345 PK extruded aluminum with neoprene sweep, mill finish.
   d. Wall Mounted door stop: Cast brass wall stop with replaceable rubber tip bumper, US 26D finish. Ives Model WS447 or approved equal.
   e. Floor Mounted Doorstop: Universal dome floor stop made from stainless steel with replaceable spring-loaded rubber bumper. Ives Model FS439 or equal.
   f. Door Hold Open: Semi-automatic, floor mounted door holder made from cast brass with US 26D finish. Ives Model FS9 or approved equal.
   g. Surface Slide Bolts: Solid ¾" w x ¾" thick x 12" long, heavy duty steel bar surface mounted slide bolt, US 2C finish. Ives Model SB360 or approved equal. Provide bolts at top and bottom of inactive door leaf.
   h. Vertical Pull Bar: 1-1/4" diameter stainless steel vertical door pull with round grip and flat ends. Rockwood RM3301 MegaTek Straight Pull in US32D finish or approved equal.

END OF SECTION

SECTION 08 81 00

GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Definitions: "Glass" includes prime glass, processed glass, and fabricated glass products. "Glazing" includes glass installation and materials used to install glass. Types of work in this section include and glass and glazing for:
   1. Window units, not indicated as "pre-glazed"
   2. Window wall/storefront construction
   3. Entrances and other doors, not indicated as "pre-glazed"
   4. Interior partitions
   5. Vision glass in doors

1.2 QUALITY ASSURANCE AND REFERENCED STANDARDS

A. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.
   1. GANA Publications
   2. AAMA PUBLICATIONS
   3. IGMA Publications

B. Safety glass products shall comply with CPSC 16 CFR 1201 for Category II materials.

C. Work of the Contract shall comply with the following standards; latest edition of each;
   1. ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance and Methods Test.
   2. ASTM C162 – Standard Terminology of Glass and Glass Products.
   3. ASTM C1036 – Standard Specification for Flat Glass.
   4. ASTM C1048 – Standard Specification for Heat-Treated Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
   6. ASTM C1376 – Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
   7. ASTM E1300 – Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
   8. ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
   9. ASTM E2189 – Standard Method for Testing Resistance to Fogging in Insulating Glass Units.
   10. ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
   11. CSPC 16 CFR 1201– Safety Standard for Architectural Glazing Materials.
   12. Insulating Glass Manufacturers Alliance (IGMA) – Glazing Guidelines.
   13. GANA Glazing Manual: Glass Association of North America.
   14. GANA Sealant Manual: Glass Association of North America.
   15. GANA Laminated Glass Design Guide: Glass Association of North America.
   16. GANA/GTA 66-9-20 – Specification for Heat-Strengthened or Fully Tempered Ceramic Enameled Spandrel Glass for Use in Building Window/Curtainwalls and Other Architectural Applications.
   17. ISO 9001 Certification.

D. Insulating glass products are to be permanently marked on spacers with appropriate label of inspecting and testing agency listed below: Insulating Glass Certification Council (IGCC).

E. Manufacturer to be ISO 9001 Certified.

F. Glazing assemblies shall comply with IECC Table 402.5.2 Maximum Air Leakage Rates for Fenestration Assemblies.

1.3 SUBMITTALS

A. Product data: Material list of products proposed to be installed that includes performance data for fabricated glass units.

B. Submit 12-inch square samples of each type of fabricated glass assembly.

C. Submit manufacturer's glazing instructions.

D. Submit compatibility and adhesion test reports from sealant manufacturer, indicating materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials used in insulating units.

E. Submit reports from fabricated glass manufacturer indicating that the glass meets the requirements of security test.

F. Mock-Ups – Refer to Division 8 Section "Aluminum Entrances and Storefronts" for requirements applicable to mock-ups.

1.4 PRODUCT HANDLING

A. Provide cushions at edges during storage and handling of glass.

B. Comply with manufacturer's instructions for receiving, handling, storing and protecting glass and glazing materials.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

E. Exercise care to prevent damage to glass and damage/deterioration to coating on glass.

1.5 SPECIAL PRODUCT WARRANTY

A. Warranty on Hermitic Seals: Provide insulating glass manufacturer's written warranty, agreeing to, within specified warranty period, furnish FOB project site, replacement units for insulating glass units which have defective hermetic seals (excluding that due to glass breakage); defined to include intrusion of moisture or dirt, internal condensation at temperatures above -20 degrees F, deterioration of internal glass coatings, and other visual evidence of seal failure or performance failure. Warranty period is 10 years after seal date permanently imprinted on unit, but not less than 9 years after date of substantial completion.

1.6 PROJECT SITE CONDITIONS

A. Field Measurements: Verify field measurements with drawing dimensions prior to fabrication of glass products.

B. Laminated Glass Warranty: Provide fabricator's written 5-year warranty.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS - GENERAL

A. Design Requirements:
   1. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to ineffective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
   2. Provide glass thickness and strengths (annealed, heat-strengthened, or tempered heat soaked) required to meet or exceed the following criteria based on project loads and in-service conditions per ASTM E1300.
      a. Minimum thickness of annealed or heat-treated glass products as selected, so that worst-case probability of failure does not exceed the following:
         i. 8 breaks per 1000 for glass installed vertically or not over 15 degrees from the vertical pane and under wind action.
         ii. 1 break per 1000 for glass installed 15 degrees from the vertical plane and under action of snow and /or wind.

B. Float/Plate Glass: Type I, Quality q3, clear unless otherwise indicated.

2.2 PROCESSED GLASS

A. Tempered Glass: Provide prime glass of color and type indicated, which has been heat treated to strengthen glass in bending to not less than 4.5 times annealed strength in accordance with ASTM C1048.
   1. Glass to be heat-treated by horizontal (roller hearth) process with inherent roller-wave distortion parallel to the bottom edge of the glass as installed when specified.
   2. Flatness Tolerances:
      a. Roller-Wave or Ripple: The deviation from flatness at any peak shall be targeted not exceed 0.003” as measured per peak to valley for 1/4:” thick glass. (Electronic read out per lite is required as a submittal of this fabrication tolerance)
      b. Bow and Warp: The bow and warp tolerances shall targeted not exceed 1/32” per linear foot.

B. Laminated Glass: Laminated Glass Makeup:
   1. Outer-Plys
      a. Glass Tint: Clear
      b. Nominal Glass Thickness: Refer to drawings
      c. Glass Strength: Tempered
   2. Interlayer
      a. Basis of Design: DuPont Sentry Glass Plus, as manufactured by Dupont Building Innovations, 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805.

2.3 FABRICATED GLASS UNITS

A. Sealed Insulating Glass Unit Surfaces & Coating Orientation
   1. Surface 1 – Exterior surface of outer pane (surface facing outdoors of outboard lite).
   2. Surface 2 – Interior surface of outer pane (surface facing indoors of outboard lite).
   3. Surface 3 – Exterior surface of inner pane (surface facing outdoors of inboard lite).
   4. Surface 4 – Interior surface of inner pane (surface facing indoor of inboard lite).

B. Heat-Glare-Light-Reducing Insulating Glass: Provide (2) sheets of glass as follows, and 1/2" dry air or gas filled space with -20 degrees F dew point, with Class A sealant type edge construction to maintain a hermitic seal.
   1. Exterior Glass: 1/4” nominal thickness quality q3 heat strengthened, gray tinted glass with Low-E coating on surface 2. Basis of design is VitroGlass (PPG) Solarban 60 on ‘Solargray’ glass, or approved equal
   2. Air space that is a nominal 1/2" wide; 90% argon filled.
   3. Interior Glass: Clear float glass, Quality q3, nominal 1/4" thick.

4. Edge Construction: Twin primary seals of polyisobutylene: tubular aluminum spacer bar frame with welded or soldered sealed corners, and filled with desiccant; and secondary seal outside of bar, bonded to both sheets of glass and bar, with polysufide silicone.
5. **Where indicated on the drawings, provide tempered glass, units for <u>both</u> interior and exterior glass sections of the fabricated glass unit**.
6. Required Center of Glass Performance: 32% to 33% visible light transmittance, 6% to 9% maximum visible exterior light reflectance, 0.19 solar heat gain coefficient, and U-value of 0.24 maximum for winter at night.
7. Warranty: Provide manufacturer's standard 10-year product warranty on maintained hermetic seal.
8. Insulating glass units shall be certified through the Insulating Glass Certification Council (IGCC) to ASTM E2190 (class “CBA”) or to ASTM E2188.

2.4 LOW-E INSULATING TINTED GLASS

A. Solarban 60 Solargray + Clear by Vitro Architectural Glass, or approved equal.
1. Performance Values: VLT 35 percent; SHGC 0.25; shading coefficient 0.36; exterior reflectance 6 percent; U-value winter 0.29; U-value summer 0.24.
2. Insulating Glass Unit Construction: 1/4 inch (6 mm) Solargray glass, Solarban 60 solar control (sputtered) on second surface (2) + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Clear glass.

2.5 GLAZING SEALANTS AND COMPONENTS

A. General: Provide color of exposed sealant/compound indicated or if not otherwise indicated, as selected by Architect from manufacturer's standard colors, or black if no color is so selected. Comply with manufacturer's recommendations for selection of hardness, depending upon the location of each application, conditions at time of installation, and performance requirements as indicated. Select materials, and variations or modifications, carefully for compatibility with surfaces contacted in the installation.

B. Glazing System: Blocks, shims - Neoprene

2.6 GLAZING GASKETS

A. Molded Neoprene Glazing Gaskets: Molded or extruded neoprene gaskets of the profile and hardness required for watertight construction; comply with ASTM D 2000 designation 2BC 415 to #bc 620, black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verifications and Conditions
1. Verify that site conditions are acceptable for the installation of the glass.
2. Verify openings for glazing are correctly sized within tolerance.
3. Verify that a functioning weep system is present.
4. Verify that the minimum required face and edge clearances are being followed.
5. Do not proceed with glazing until satisfactory conditions have been achieved.

3.2 CUTTING

A. Glass for lites shall be shop cut from field measurements. No cutting or nipping shall be performed at project site. Cuts shall be clean, only moderately convoluted, with shark teeth extending not more than 1/4 of glass thickness.

B. Unacceptable Cut Defects:
1. Impact chips, spalls, nipped edges, or flake chips or shark teeth deeper than 1/4 of glass thickness, or serration hackle deeper than 1/8 or glass thickness.
2. Flare of bevel shall not exceed 1/8 of glass thickness.

3.3 INSTALLATION

A. For fire rated openings follow printed instructions of frame manufacturer and glazing manufacturer.

B. Install products using the recommendations from the manufacturer of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the “GANA Glazing Manual.”

C. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.

D. Remove coating and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.

E. Install glass in prepared glazing channels and other framing members.

F. Install setting blocks in rabbets as recommended by referenced glazing standards in “GANA Glazing Manual” and “IGMA Glazing Guidelines.”

G. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by “GANA Glazing Manual.”

H. Provide weep system as recommended by “GANA Glazing Manual.”

I. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.

J. Distribute the weight of glass unit along the edge rather than the corner.

K. Comply with manufacturers and referenced industry standards on expansion joints and anchors; accommodating thermal movement; glass openings; use of setting blocks, edge, face, and bite clearances; use of glass spacers; edge blocks and installation of weep systems.

L. Protect glass edge damage during handling and installation.

M. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.

N. Remove and replace glass that is broken, chipped cracked or damaged in any way.

3.4 CLEANING

A. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

B. Glass to be cleaned according to:
   1. GANA Glass Informational Bulletin GANA 01-0300 – “Proper Procedure for Cleaning Architectural Glass Products.”
   2. GANA Glass Informational Bulletin GANA TD-02-0402 – “Heat Treated Glass Surfaces are Different.”

C. Do not use razor blades, scrapers or metal tools to clean glass.

D. Clean labels, dirt, paint splatter, and other opaque matter from glass, including protective X marks at completion of project. Polish glass.

E. Masking shall not be exposed to sunlight and shall be removed from glazing material immediately after installation.

F. Fresh paint splashes and smeared glazing compounds shall be removed before drying by rubbing lightly with isopropyl alcohol, a good grade of naphtha, or butyl cellosolve. Do not use abrasive or highly alkaline cleaners, benzene, leaded gasoline, acetone, carbon tetrachloride or sharp instruments.

G. A final wash shall be made using a mild soap followed by a thorough rinse with clean water. Dry thoroughly with a chamois or moist cellulose sponge to prevent water spots.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Types of work include:

1. Gypsum drywall including screw type metal support system.
2. Gypsum backing boards for application of other finishes
3. Drywall finishing (joint tape and compound treatment)

1.2 QUALITY ASSURANCE

A. Fire Resistance Rating: Where gypsum drywall systems with fire resistance ratings are indicated or are required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL.

B. Manufacturer: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.3 REFERENCES

A. Gypsum Board Standard: Comply with applicable requirements of ANSI/ASTM C 840 for application and finishing of gypsum board, unless otherwise indicated.

B. Steel Framing Standard: Comply with applicable requirements of ASTM C 754 for installation of steel framing for gypsum board.

C. Gypsum Board Terminology Standard: GA-505 by Gypsum Association

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

B. Control Joint Plan: Submit floor plans and reflected ceiling plans marked with proposed locations of control joints.

1.5 PRODUCT HANDLING

Delivery, identify, store and protect gypsum drywall materials to comply with referenced Standards.

1.6 JOB CONDITIONS

Environmental Conditions: Comply with referenced standards.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, provide products of one of the following:

A. Metal Support Materials:

1. Gold Bond Building Products Div. National Gypsum
2. Georgia Pacific Corp
3. United States Gypsum Co.

B. Gypsum Board and Related Products

1. Flintkote Company

2. Georgia Pacific Corp.
3. Gold Bond Building Products Div., National Gypsum
4. United States Gypsum Co.

2.2 WALL/PARTITION SUPPORT MATERIALS

A. Studs:
1. ASTM C 645; 20 gage unless otherwise indicated.
2. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

B. Furring Members: Interior Partitions: ASTM C 645; 25 gage, hat shaped. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

C. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the substrate and application indicated.

2.3 GYPSUM BOARD

A. Gypsum Wallboard:
1. Types, edge configuration and thickness indicated; in maximum lengths available to minimize end to end butt joints.
2. Type:
a. General Use for Walls and Ceilings: ASTM C1396 lightweight 5/8” thick Non-Type X unless otherwise noted, produced with 90% or greater recycled content. GREENGUARD Gold Certification, USG sheetrock brand “ECOSMART PANELS FIRECODE 30” or approved equal.
b. Fire Rated Wall and Ceiling Assemblies: ASTM C1396 Type X lightweight 5/8” thick unless otherwise noted, produced with 90% or greater recycled content, GREENGUARD Gold Certification, USG sheetrock brand “ECOSMART FIRECODE – X” or approved equal.
c. Restrooms, Janitor Closets and Other Wet Areas: Where a gypsum wallboard painted finish is indicated on the drawings: ASTM C1396 Type X lightweight 5/8” thick unless otherwise noted, moisture and mold resistant, GREENGUARD Gold Certification, produced with 90% or greater recycled content, USG sheetrock brand “ECOSMART PANELS MOLD TOUGH FIRECODE X” or approved equal.
d. Ceramic Tile Walls: Provide ½” thick cement board tile backer in lieu of gypsum wallboard. Refer to tile section.
3. Edges: Tapered
4. Thickness: As indicated, or if not otherwise indicated, as required to comply with ASTM C 840 for application system and support spacing indicated.

B. Water Resistant Backing Board:
1. ASTM C 630, with tapered edges and of type and thickness indicated; in maximum lengths available to minimize end to end butt joints.
2. Type:
a. Regular, except where otherwise indicated
b. Type X for fire resistant rated assemblies
3. Thickness: As indicated, or if not otherwise indicated, provide 5/8".

C. Trim Accessories:
1. General:
Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim beads, U-type

edge trim beads, special L-kerf type edge trim beads, and one piece control joint beads.

2. Type
   a. Metal type: Form from zinc-coated steel not lighter than 26 gage, complying with Federal Specification QQ-S-775, type I Class D or E, designed for embedding in joint compound.
   b. Semi-Finishing Type: Manufacturer's standard trim units which are not to be finished with joint compound (non beaded).
3. Plastic Edge Trim: Manufacturer's standard rigid or semi-rigid PVC moldings of the semi-finished type, shaped to provide resilient contact of gypsum board edges with other work; friction fit, or pressure sensitive adhesive mounting.
4. H-Molding: Manufacturer's standard extruded aluminum H-molding of height required for board, designed for combination trim and control joint in exterior gypsum board ceiling/soffit work.
5. Beads:
   a. Casing beads: Provide channel shapes with exposed wing, and with a concealed wing not less than 7/8" wide. The exposed wing may be covered with paper cemented to the metal, but shall be suitable for joint treatment.
   b. Corner beads: Provide angle shapes with wings not less than 7/8" wide and perforated for nailing and joint treatment, or with combination metal and paper wings bonded together, not less than 1-1/4" wide and suitable for joint treatment.
6. Edge beads for use at perimeter of ceilings:
   a. Provide angle shapes with wings not less than 3/4" wide.
   b. Provide concealed wing perforated for nailing, and exposed wing edge folded flat.
   c. Exposed wing may be factory finished in white color.

D. Joint Treatment Materials:
1. General: Type recommended by the manufacturer for the application indicated, except as otherwise indicated. **Do not use gypsum wall board joint treatments on tile backer board.**
2. Joint Tape: Special cross fibered paper tape made for wallboard joint applications using pre-mixed joint compound; USG Beadex brand drywall tape or approved equal.
3. Interior Joint Compound: Ready-mixed type. ASTM475 Grade – A single multi-purpose grade
4. Water Resistant Joint Compound: Special water resistant type for treatment of joints, fastener heads and cut edges of water resistant backing board.

E. Miscellaneous Materials:
1. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
2. Anchorage:
   a. Gypsum Board Screws: Comply with ASTM C 646
3. Acoustical Sealant: Water base type, non-drying, non-bleeding, non-staining type; permanently elastic, as recommended by gypsum board manufacturers for application indicated.
4. Sound Attenuation Blanket: FS HH-I-521, Type I; semi rigid mineral fiber blanket without membrane; Class 25 flame spread, K value of 0.25; designed for use with metal studs or Z-furring members, of thickness and width to completely fill void formed by metal framing members; density between 4.0 and 6.0 lbs. per cubic foot depending on thickness.

PART 3 – EXECUTION

3.1 PREPARATION FOR METAL SUPPORT SYSTEMS

A. Ceiling Anchorages:

1. Coordinate work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.
2. Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination with other work.

3.2 INSTALLATION OF METAL SUPPORT SYSTEMS

A. General:

1. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.
2. Nail or screw furring members to wood framing as indicated.

B. Wall/Partition Support Systems (non-load bearing walls):

1. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum board alone.
2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
3. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
4. Unless otherwise noted, extend partition stud system through suspended ceilings, and elsewhere as indicated, to the structural support and substrate above the ceiling.
5. Space studs 16" on center, except as otherwise indicated.
6. Frame door openings with vertical studs securely attached by screws at each jamb either directly to frames or to jamb anchor clips on door frame. Install runner track sections (for jack studs) at head and secure to jamb studs with a cripple stud. Provide two (2) full height studs, back to back with a track piece wrapped around the jamb stud, at both sides of door openings unless otherwise indicated.
7. Provide runner tracks of same gage as jamb studs. Space jack studs same as partition studs.
8. Frame openings other than door openings in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.
9. Space wall furring members 16" on center, except as otherwise indicated.
10. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.3 GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Product Instructions: Install gypsum wallboard products in strict compliance with manufacturer's published instructions. Incorporate isolation techniques and control joints as recommended by manufacturer. Submit plans indicating the arrangement and configuration of exposed isolation or control joints to the Architect for approval of the visual effect.

B. General:

1. Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.
2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
3. Locate ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".

4. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
5. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
6. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill cut or field cut ends against mill cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
7. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts.
8. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories. Utilize manufacturer's standard control joint trim piece to form exposed joints.
9. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
10. Isolate perimeter of non-load bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.
11. Where sound-rated drywall work is indicated (STC rating), including double layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with manufacturer's recommendations for location of beads, and close off sound flanking paths around or through the work, including sealing of partitions above acoustical ceilings.
12. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

C. Methods of Gypsum Drywall Application:
   1. Single Layer Application:
      a. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
      b. On partitions/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
      c. On partitions/walls 8'-1" or more in height apply gypsum board horizontally (perpendicular), use maximum length sheets possible to minimize end joints.
      d. On Z-furring members apply gypsum board vertically (parallel) with no end joints. Locate edge joints over furring members.
   2. Wall Tile and Wet Areas:
      a. Where ceramic tile wall finish is specified, substitute ½" thick cement board tile backer for the gypsum wallboard.
      b. In wet areas, including all restrooms and janitor closets, provide 5/8" water resistant gypsum wallboard where paint finish is specified.
   3. Single Layer Fastening Methods:
      a. Apply gypsum boards to supports as follows:
         Fasten with screws.

D. Installation of Drywall Trim Accessories
   1. General:
      a. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by

nailing or stapling in accordance with manufacturer's instructions and recommendations.

b. Install metal corner beads at external corners of drywall work.

c. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant filled (including expansion joints).

d. Install J-type semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings.

e. Install plastic edge trim where indicated on wall panels at juncture with ceilings.

f. Install metal control joint (beaded type) where indicated.

g. Install H molding in exterior gypsum drywall work where control joints are indicated.

E. Finishing of Drywall

1. General:

a. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

b. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

c. Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last 2 coats and after last coat.

2. Water Resistant Gypsum Board:

a. Treat joints and fasteners to comply with directions of water resistant joint compound manufacturer.

b. In areas to be tiled, treat fastener heads with water-resistant joint compound. Fill tapered edges in gypsum panels with water resistant joint compound, embed joint tape firmly and wipe off excess compound; follow immediately with a second coat of water resistant joint compound over taping coat, being careful not to crown the joint. Fold and embed tape in all interior angles to form true angle.

c. In areas not to be tiled, treat fastener heads and embed tape as indicated above using water resistant joint compound but finish with 2 coats of joint compound used for regular gypsum board work.

3. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing or which requires finishing to achieve fire resistance rating, sound rating or to act as air or smoke barrier.

4. Finishing Levels:

a. Level 0: No taping, finishing, or accessories required.

b. Concealed areas not exposed to view:
GA-214-96 Level 1: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

c. Walls with cement board over the wallboard for tile:
GA-214-96 Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be

considered a separate coat of joint compound and shall satisfy the conditions of this level.

d. Walls and Ceilings of Utility Rooms, Mechanical Rooms:
GA-214-96 Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound hall be smooth and free of tool marks and ridges.

e. Walls and Ceilings to receive painted finish, except as otherwise indicated:
GA-214-96 Level 5: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat (Ref: Terminology, Section II, page 2) of joint compound or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

3.4 PROTECTION OF WORK

Installer shall advise Contractor of required procedures for protecting gypsum drywall work from damage and deterioration during remainder of construction period.

3.5 CRACK REPAIRS

Contractor is responsible for patching and repairing cracks that occur in the gypsum wallboard system for a period of (2) years from the date of substantial completion.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of tile work is indicated on the drawings and schedules.

B. Section includes:
   1. Porcelain wall tiles
   2. Tiling trim, setting materials, and accessories

1.2 QUALITY ASSURANCE

A. Source of Materials: Provide materials obtained from one source for each type and color of tile, grout, and setting materials.

B. Reference Standards:
   The work of this section shall be executed and tested in accordance with current editions of the following standards:
   1. Tile Council of North America Handbook
   2. ANSI A 108

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical information and installation instructions for materials required, except bulk materials.

B. Samples: Submit samples of each type of tile for each color and texture required, not less than 12" square.

C. Certifications: Furnish Master Grade Certificates for each shipment and type of tile, signed by manufacturer and installer.

1.4 PRODUCT HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

B. Maintain temperatures at not less than 50 degrees F in tiled areas during installation and or 7 days after completion, unless higher temperatures required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCT

2.1 MANUFACTURER

Subject to compliance with requirements, provide products of one of the following manufacturers:

A. Latex Portland Cement Grout:
   1. TEC/H.B. Fuller
   2. L & M Surco

3. American Olean

2.2 PRODUCTS, GENERAL

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 for types and grades of tile indicated.

B. Colors, Textures and Patterns:
1. For tile and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated or, if not otherwise indicated, as selected by the Architect from manufacturer's standards.
2. Provide tile trim and accessories which match color and finish of adjoining flat tile unless otherwise indicated.

2.3 TILE PRODUCTS

A. Porcelain Floor Tile:
Provide flat tile complying with the following requirements:
Type: Porcelain
Nominal Facial Dimensions: 12” x 12”
Nominal Thickness: 8 mm
Edge: Pressed
Face: Glazed
Product: Florida Tile ‘High Ridge’
Color: Pinnacle Beige
Pattern: Running Bond

B. Porcelain Wall Tile:
Provide flat tile complying with the following requirements:
Type: Porcelain
Nominal Facial Dimensions: 12” x 12”
Nominal Thickness: 8 mm
Edge: Pressed
Face: Glazed
Product: Florida Tile ‘High Ridge’
Color: Pinnacle Beige
Pattern: Running Bond

2.4 SETTING MATERIALS

A. Portland Cement Mortar Base Installation Materials:
Provide materials to comply with ANSI A 108.1 as required for installation method designated, unless otherwise indicated.
1. Portland Cement: ASTM C-150 Type I
2. Sand: ASTM C-144
3. Water: Potable
4. Mix Design: 1-part Portland cement, 6 parts damp sand by volume

B. Thin Set Portland Cement Mortar Bond Coats:
Where thin set Portland cement mortar applications are indicated, use the following unless otherwise required.
1. Latex Portland cement mortar, ANSI A118.4

C. Organic Adhesive: Prepared organic material ready to use with no further addition of liquid or powder, which cures or sets by evaporation, meeting requirements of ANSI A136.1.

2.5 GROUTING MATERIALS

A. Epoxy Grout

1. Manufacturer: Laticrete
2. Product: Spectralock Pro Grout
3. Color: As selected by Architect from full range of manufacturer's standard colors

2.6 CEMENTITUOUS TILE BACKER BOARD

Fiberglass mesh reinforced cement boards specifically manufactured for use as tile backer conforming to ASTM 1325, 1/2" nominal thickness, unless otherwise noted on the drawings.

2.7 MISCELLANEOUS MATERIALS

A. Metal Trim:
   1. Floor tile edge trim at transition to different floor material:
      a. Flush transition: Schluter "Vinpro-T"
      b. Reducing transition: Schluter "Vinpro-U"
   2. Wall tile outside corner trim: Schluter "Quadec" prefabricated metal tile trim, or approved equal.
   3. Wall tile cap trim: Schluter "Quadec" prefabricated metal tile trim, or approved equal.
   4. Metal Trim Material and Finish: Anodized aluminum

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

B. TCNA Installation Guidelines: Comply with TCNA "Handbook for Ceramic, Glass, and Stone Tile Installation" (latest edition) installation methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.

C. General:
   1. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
   2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.

D. Jointing Pattern:
   Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.
   1. Joint Schedule: minimum joint width as recommended by the product manufacturer

E. Grouting: Grout tile to comply with referenced installation standards, using grout materials indicated.

F. Metal Trim Installation:
   Coordinate trim installation with tile setting and substrate. Set trim in accordance with manufacturer's installation instructions.

3.3 WALL INSTALLATIONS

A. Install tile to comply with requirements indicated below for setting method, TCA installation method related to types of wall construction, and grout types.

Wall Tile:
TCNA Handbook method number W244C
Substrate: Reinforced cement board units, joints taped with glass fiber mesh
Bond Coat: Thin set portland cement mortar
Grout: Epoxy grout

Floor Tile:
TCNA Handbook method number F112
Substrate: Concrete slab
Bond Coat: Thin set portland cement mortar
Grout: Epoxy grout

3.4 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

B. Protection:
1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage and wear.
2. Prohibit foot and wheel traffic from using tiles floors for at least 7 days after grouting is completed.
3. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide acoustical ceilings including panels, Suspension System, Supplemental Supports and Framing, Reinforcing, and Trim.

B. Description of Work:
   1. The extent of each type of acoustical ceiling is shown and scheduled on the drawings.
   2. Types of acoustical ceilings specified in this section include the following: Acoustical panel ceilings and exposed suspension system

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than 3 years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.

B. Fire Performance Characteristics:
   1. Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.
   2. Surface Burning Characteristics:
      a. Flame Spread: 25 or less
      b. Smoke Developed: 50 or less

C. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.
   2. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.5 PROJECT CONDITIONS

Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units:
   1. Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).
   2. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.

B. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range to match specified panel as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two Room Method" with ceilings continuous at partitions and support suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

C. Colors, Textures, and Patterns: Provide products to match appearance characteristics of specified panel herein after designated.

2.2 ACOUSTICAL PANELS

A. Acoustical Panel 'A': Armstrong World Industries "Optima" 24” x 24” x 1” smooth textured surface, tegular lay-in, Model 3354 with 0.90 NRC and CAC 26, or approved equal.

2.3 METAL SUSPENSION SYSTEM, GENERAL

A. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

B. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

2.4 METAL SUSPENSION SYSTEM COMPONENTS

A. Metal Suspension System: Prelude XL 15/16-inch grid from Armstrong World Industries, or approved equal.

B. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, prestretched, Class 1 coating, sized so that stress at 3 times hanger design load (ASTM C 635, table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gauge.

C. Edge Moldings and Trim:
1. Provide manufacturer's standard metal molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. Provide special corrosion resistant moldings to match suspension system where indicated as high humidity.

PART 3 - EXECUTION

3.1 PREPARATION
A. Coordination:
1. Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
2. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans wherever possible.

3.2 INSTALLATION
A. General:
1. Install materials in accordance with manufacturer's printed instructions, and to comply
with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
2. Arrange units and orient directionally patterned units (if any).
3. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'-0" along each carrying channel or direct hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
4. Secure wire hangers by looping and wire tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
5. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to avoid obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.
6. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
7. Screw attach moldings to substrate at intervals not over 16" on center and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0".
8. Miter corners accurately and connect securely.
9. Install acoustical panels in coordination with suspension system, with field cut tapered edges to match profile of factory edge using special cutting tools. Scribe and cut panels to fit accurately at borders and at penetrations.

3.3 ADJUST AND CLEAN
Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.4 EXTRA STOCK

A. Deliver stock of maintenance material to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

B. Acoustical Ceiling Panels: (10) of each panel type

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

The extent of resilient flooring systems is shown on the drawings and in schedules.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

B. Fire Test Performance:

1. Unless otherwise indicated, provide resilient flooring having the following classifications or properties when tested in accordance with the standard fire tests referenced below:
   a. Critical Radiant Flux: Class I
   b. Flame Spread: Not more than 75 as per ASTM E 84.
   c. Smoke Developed: Not more than 450 as per ASTM E 84.
   d. Smoke Density: Not more than 450 as per NFPA 258.

C. Installer Qualifications: Select an installer experienced and competent in the installation of resilient flooring and the use of subfloor preparation products. Engage installers certified as Manufacturer’s Commercial Flooring Certified Installers.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of resilient flooring system including all materials, components and accessories required to develop the performance specified.

B. Samples: Submit, for verification purposes, samples of each type, color, and pattern of resilient flooring.

C. Certification for Fire Test Performance: Submit manufacturer's certification that resilient flooring furnished complies with required fire test performance and has been tested and meets indicated requirements.

D. Maintenance Instructions: Submit manufacturer's recommended maintenance practices for each type of resilient flooring and accessory.

E. Certification of Installer: Submit verification of manufacturer’s certification of installer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Deliver materials in good condition to the jobsite in the manufacturer’s original unopened containers that bear the name and brand of the manufacture, project identification, shipping, and handling instructions.

C. Store materials in a clean, dry enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.5 PROJECT CONDITIONS

Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF and a maximum temperature of 85ºF for at least 48 hours before, during, and for not less than 48 hours after installation. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

1.6 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 15 year

C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.7 EXTRA STOCK

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed, packaged with protective covering for storage and identified with appropriate labels.
   1. Quantity: Furnish quantity of flooring units as follows:
      a. LVP- (10) full size planks
      b. VCT- (10) full size tiles
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra material.

PART 2 - PRODUCTS

2.1 MATERIALS-GENERAL

A. Single-Source Responsibility: Provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.

2.2 LUXURY VINYL PLANK (LVP)

A. Provide Luxury Vinyl Tile: The Magic Hour- Horizon by Milliken
   1. Construction: High Performance Luxury Vinyl Tile
   2. Finish: ProGuard MAX Coating
   3. Wear Layer Thickness: 22 mil
   4. Total Thickness: 5.0 mm
   5. Edge Profile: Straight
   6. Nominal Dimensions: 25 cm x 150 cm
   7. Color: To be selected by Architect from manufacturer's full range of standard colors
   8. Pattern: Random

2.3 VINYL COMPOSITION TILE (VCT)

A. Provide Vinyl Composition Tile: FS SS-T-312, Type IV; 12" x 12" unless otherwise indicated, and as follows:
   1. Armstrong Excelon
   2. Composition 1: Asbestos-free
   3. Gage: 1/8"
   4. Color: To be selected by Architect from manufacturer's full range of standard colors

C. Resilient Edge Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color to match flooring, or as selected by Architect from standard colors available; not less than 1" wide.

D. Adhesive: Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

E. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

F. Leveling Compound: Latex type as recommended by flooring manufacturer.

2.4 ACCESSORIES

A. For patching, smoothing, and leveling monolithic subfloors provide only Portland based patching and leveling compounds.

B. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

F. Provide transition/reducing strips tapered to meet abutting material.

G. Provide threshold of thickness and width as shown on the drawing.

H. Provide resilient edge strips of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

I. Provide metal edge strips of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTION

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instruction, and product carton instructions for installation and maintenance procedures as needed.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate condition are acceptable for product installation in accordance with manufacturer's instruction (i.e. moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed.

C. Test existing and new concrete floor slab in accordance with the ASTM F 1869 Standard Test Method for measuring vapor emission rate of concrete subfloor using anhydrous calcium chloride.

Perform subfloor moisture testing and bond tests as described in the manufacturer's manual, to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not

exceed 75%. MVER shall not exceed 3 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

D. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

E. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

F. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

G. Failure to call attention to defects or imperfections will be constructed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.3 PREPARATION

A. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

B. Comply with ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. Broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might aft the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate they shall be mechanically removed prior to the installation of the flooring material.

D. Grind all concrete deck ridges and imperfections greater than 1/16" down smooth and flush to the deck surface using power grinders.

E. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.

Smooth concrete surfaces, removing rough area, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring [S-184 Fast-Setting Cement-Based Patch and Underlayment] [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-453 Level Strong cement based self-leveling compound] [S-456 Patch Strong flexible patching and smoothing compound] [S-454 Prime Strong acrylic primer for porous substrates] [S-455 Prime Strong acrylic primer for non-porous substrates] as recommended by the flooring manufacturer.

F. Perform bond and moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured, dried and ready to receive flooring.

G. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.4 INSTALLATION

A. General:
   1. Where movable partitions are shown, install resilient flooring before partitions are erected.
   2. Install flooring using method indicated in strict compliance with manufacturer's recommendations. Extend flooring into toe spaces, door reveals, and into closets and similar openings.
   3. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
   4. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around cover and to covers.
   5. Tightly cement flooring to subbase without open cracks, voids, raising and puckering joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll flooring at perimeter of each covered area to assure adhesion.

B. Tile Floors
   1. Install flooring in strict accordance with the latest edition of manufacturer’s instructions and installation guide.
   2. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into tow spaces, door recesses, closets, and similar openings as shown on the drawings.
   3. Install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
   4. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, built-in furniture, cabinets, door frames, and other interruptions.
   5. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer’s written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
   6. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
   7. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

8. Lay tile in "checkerboard" fashion with grain reversed in adjacent tiles.
9. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.

C. Accessories
1. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
2. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
3. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.
4. Apply overlap metal edge strips where shown on drawings, and after flooring installation. Secure units to substrate with countersunk stainless steel anchors, complying with manufacturer's recommendations.
5. Apply butt type metal edge strips where shown on drawings, and prior to resilient flooring. Secure units to substrate with countersunk stainless steel anchors, complying with manufacturer's recommendations.
6. Apply resilient accessories to stairs as indicated and in strict accordance with manufacturer's installation instructions.
7. Fill voids with plastic filler along the top edge of the resilient wall base or integral voce cap on masonry surfaces or other similar irregular substrates.

3.5 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring with heavy Kraft paper or other covering.

B. After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.

C. Apply polish and buff, with type of polish, number of coats, and buffing procedures in compliance with flooring manufacturer’s instructions.

END OF SECTION

SECTION 09 65 02

STATIC DISSIPATIVE RESILIENT FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK
The extent of static dissipative resilient flooring systems is shown on the drawings and in schedules.

1.2 SUMMARY
A. Section Includes:
1. Static-control, vinyl composition floor tile.

B. Related Requirements:
1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.

B. Samples: For each type of static-control resilient flooring and in each color, pattern, and texture required, in manufacturer's standard size, but not less than 6 by 6 inches.

C. Product Schedule: For static-control resilient flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.

B. Product Test Reports: For static-control resilient flooring, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

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. Floor Tile: Furnish (5) full tiles for each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE
A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in installation techniques required by manufacturer for specified static-control resilient flooring.
1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required for specified products.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended in writing by manufacturer, but not less than 55 deg F or more than 90 deg F.

1. Floor Tile: Store on flat surfaces.

1.9 PROJECT CONDITIONS

A. Maintain ambient temperatures in spaces to receive static-control resilient flooring within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) during the following time periods:
   1. Period recommended in writing by manufacturer before installation.
   2. During installation.
   3. Period recommended in writing by manufacturer after installation.

B. Until Substantial Completion, maintain ambient temperatures in installation areas within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during static-control resilient flooring installation.

D. Close spaces to traffic for period recommended in writing by manufacturer after static-control resilient flooring installation.

E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 STATIC-CONTROL, VINYL COMPOSITION FLOOR TILE (SDT)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Armstrong World Industries, Inc. Basis of Design Product, Excelon SDT, or approved equal

B. Source Limitations: Obtain floor tile from single source from single manufacturer.

C. Static-Control Properties: As determined by testing identical products in accordance with test method indicated by an independent testing and inspecting agency.
   1. Electrical Resistance:
      a. Material: Point-to-point and point-to-ground resistances between 106 and 109 ohms when tested in accordance with ASTM F150
      b. Material in Combination with a Person: Average resistance of 448,000,000 ohms when tested in accordance with ESD STM97.1.
   2. Static Generation: When tested in accordance with ESD STM97.2, an average of less than 30 V when tested at 12 percent relative humidity with static-control footwear.

D. Critical Radiant Flux: 0.45 W/sq. cm or greater in accordance with ASTM E648 or NFPA 253.

E. Construction: ASTM F1066 Class 2, vinyl composition floor tile, through pattern.

F. Thickness: 1/8 inch (3.2 mm).

G. Size: 12 by 12 inches (305 by 305 mm)

H. Colors and Patterns: As indicated on drawings

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Seamless-Installation Accessories:
   1. Heat-Welding Bead: Solid-strand product of manufacturer for heat welding seams.
      a. Color: As selected by Architect from manufacturer's full range
   2. Chemical-Bonding Compound: Product of manufacturer for chemically bonding seams.

E. Floor Polish: Provide protective, static-control liquid floor polish products recommended in writing by floor-covering manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with installation or static-control characteristics of floor coverings.

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

3.2 PREPARATION

A. Prepare substrates in accordance with manufacturer's written instructions to ensure successful installation of static-control resilient flooring and electrical continuity of floor-covering systems.

B. Concrete Substrates: Prepare in accordance with ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrate alkalinity is not less than 5 or more than 9 pH unless otherwise recommended in writing by flooring manufacturer.
   4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
   1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient flooring in accordance with manufacturer's written instructions.

B. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.
   1. For adhesively installed flooring, embed grounding strips in static-control adhesive.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
   1. Extend static-control resilient flooring below built-in items and permanent, but movable, items that allow for a flexible layout where indicated on Drawings.

D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings.

E. Extend static-control resilient flooring to center of door openings where flooring or color transitions occur.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhesive Installation: Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 INSTALLATION OF FLOOR TILE

A. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
   1. Lay floor tiles square with room axis.

B. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
   1. Lay vinyl composition floor tiles with grain direction alternating in adjacent floor tiles (basket-weave pattern)

C. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to test electrical resistance of static-control resilient flooring in accordance with ASTM F150 for compliance with requirements.
   1. Arrange for testing after the following:

a. Static-control adhesives have fully cured.
b. Static-control resilient flooring has stabilized to ambient conditions.
c. Ground connections are completed.

2. Arrange for testing of static-control resilient flooring before and after performing floor polish procedures.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:
1. Remove static-control adhesive from exposed surfaces.
2. Remove dirt and blemishes from exposed surfaces.
3. Sweep and vacuum surfaces thoroughly.
4. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
1. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties. Before polishing, do the following:
a. Ensure that static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.
b. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.

D. Cover static-control resilient flooring and protect from rolling loads until Substantial Completion.

END OF SECTION

SECTION 09 65 05

RESILIENT WALL BASE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK
The extent of resilient wall base and accessories is shown on the drawings and in schedules.

1.2 QUALITY ASSURANCE
A. Manufacturer:
1. Provide each type of resilient wall base and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.
2. Where possible, provide required resilient flooring and accessories produced by a single manufacturer.

B. Fire Test Performance:
1. Unless otherwise indicated, provide resilient flooring having the following classifications or properties when tested in accordance with the standard fire tests referenced below:
a. Critical Radiant Flux: Not less than the following rating as per ASTM E 648.
i. 0.45 watts per square centimeter
ii. 0.22 watts per square centimeter
b. Flame Spread: Not more than 75 as per ASTM E 84.
c. Smoke Developed: Not more than 450 as per ASTM E 84.
d. Smoke Density: Not more than 450 as per NFPA 258.

1.3 REFERENCES
Resilient Floor Covering Institute Recommended Specification for Resilient Floor Covering

1.4 SUBMITTALS
A. Product Data: Submit manufacturer's technical data and installation instructions for each type of resilient flooring and accessory.

B. Samples:
1. Submit, for verification purposes, samples of each type, color, and pattern of resilient wall base, including accessories, required, indicating full range of color and pattern variation
2. For initial selection of colors and patterns submit, prior to above, samples in form of actual sections of resilient wall base, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.

C. Certification for Fire Test Performance: Submit manufacturer's certification that resilient flooring furnished for areas indicated complies with required fire test performance and has been tested and meets indicated requirements.

1.5 REPLACEMENT MATERIAL
A. After completion of work, deliver to project site replacement materials from same manufactured lot as materials installed, and as follows:
1. 40 linear feet of wall base material

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Subject to compliance with requirements, provide products of one of the following:
   1. Tarkett
   2. Armstrong World Industries
   3. Allstate

2.2 MATERIALS

A. Wall Base:
   Provide vinyl base complying with FS SS-W-40, Type II, with matching end stops and preformed or molded corner units, and as follows:
   1. Height: 4”
   2. Thickness: 0.080" gage
   3. Style: Standard top-set cove
   4. Finish: Matte
   5. Color: To be selected by Architect from manufacturer’s full range of standard colors

B. Adhesives: Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Broom clean or vacuum surfaces to be covered and inspect substrate. Start of wall base installation indicates acceptance of subfloor conditions and full responsibility for completed work.

3.2 INSTALLATION

A. General:
   1. Where movable partitions are shown, install resilient wall base before partitions are erected.
   2. Install wall base in strict compliance with manufacturer's recommendations. Extend wall base into toe spaces, into closets and similar openings.
   3. Tightly cement wall base to substrate without open cracks, voids, raising and puckering joints, telegraphing of adhesive, or other surface imperfections.
   4. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
   5. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

3.3 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by wall base manufacturer.

B. After completion of project and just prior to final inspection of work, thoroughly clean wall base and accessories.

END OF SECTION

SECTION 09 65 12

RUBBER FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

The extent of rubber resilient flooring and accessories is shown on the drawings and in schedules. Rubber resilient flooring includes sheet flooring, adhesives, and accessories to create a homogenous flooring system.

A. The work of this section includes:
   1. Performance Fusion Bonded Vulcanized Composition Rubber Rolls

1.2 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions, and manufacturer's warranty requirements.

1.3 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. American Society for Testing & Materials (ASTM):
   1. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
   2. ASTM F137 Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus.
   3. ASTM F970 Standard Test Method for Static Load Limit.
   4. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
   5. ASTM F925 Standard Test Method for Resistance to Chemicals of Resilient Flooring.
   6. ASTM C423 standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   7. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   8. ASTM E492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies using the Tapping Machine.
   9. ASTM E413 Classification for Rating Sound Insulation.
   10. ASTM E2129 Standard Practice for Data Collection for Sustainability Assessment of Building Products.
   11. ASTM D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
   12. ASTM F150 Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
   13. ASTM D297 Standard Practice for Rubber Products – Chemical Analysis.

14. ASTM D3676 Standard Specification for Rubber Cellular Cushion used for Carpet or Rug Underlay.
15. ASTM D395 Standard Test Methods for Rubber Property – Compression Set.
16. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
17. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.
18. ASTM F1292 Standard Specification for Impact Attenuation of Surfacing Materials within the use Zone of Playground Equipment.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's guide specifications product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors, patterns, and textures.

D. Samples: Submit selection and verification samples for finishes, colors, and textures.

E. Quality Assurance Submittals: Submit the following:
1. Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.
2. Manufacturer's Instructions: Manufacturer's installation instructions.
3. Manufacturer's Field Reports: Manufacturer's field reports specified herein.

F. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.6 PROJECT CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights owner may have under contract documents.
1. Warranty Period: 5 years commencing on Date of Substantial Completion.

1.8 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.9 MAINTENANCE

A. Extra Materials: Deliver to owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
   1. Quantity: Furnish quantity of recycled rubber flooring units equal to 10% of amount installed.
   2. Delivery, Storage, and Protection: Comply with owner's requirements for delivery, storage, and protection of extra materials.
   3. Cleaning: Furnish flooring manufacturer's neutral cleaner for initial cleaning and maintenance of the finished floor surface.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Ecore
   1. Address: 715 Fountain Ave., Lancaster, PA 17601: Telephone: (800) 322-1923, (717) 295-3400: Fax (717) 295-3414; Email: info@ecoreintl.com

2.2 RUBBER RESILIENT FLOORING

A. Ecore Performance Rolls and Interlocking Tiles manufactured by Ecore for indoor fitness applications, or approved equal
   1. Product: Ecore Performance Motivate Rolls with a 5mm Base Layer and a 2.5mm EPDM surface layer, or approved equal.
   2. Material: Made from a formulation of high-quality post-consumer vulcanized composition rubber granules encapsulated in a wear and water-resistant elastomeric network with a fusion bonded reprocessed ColorMill™ EPDM surface layer.
   3. Sheet Dimension: 48" x 50 LF x 7.5 mm
   4. Sheet Standard Tolerances: Roll width: + ¾" – 0", Roll length: +1% - 0", Thickness: ± .6 mm.
   5. Colors: Architect to select from manufacturer's full range of standard colors.
   6. Static Load Limit (ASTM F970): < 0.004"
   7. Coefficient of Friction (ASTM D2047): > 0.9
   8. Chemical Resistance: Good (ASTM F925)
   9. Noise Reduction coefficient: 0.15 sabine/ft² (ASTM C423)
   10. Impact Insulation Class: 54 (ASTM E492)
   11. Sound Transmission Class: 53 (ASTM E90)
   12. VOC Washington State IAQ Test: pass (ASTM D5116)
   13. Static Decay FTM 4046 of FS 101B: 0.01 seconds
   14. CHPS/CA 01350 (ASTM D5116): pass
   15. Resistance to Light by Color Change: Pass (ASTM F1515)
   16. Resistance to Heat by Color Change: Pass (ASTM F1514)
   17. Abrasion Resistance: <1g, 1000 cycles (ASTM D3389)
   18. Flammability – Critical Radiant Flux: Class II (ASTM E648)
   19. Flammability – Pill Test: Pass (ASTM D2859)
   20. Force reduction: 12.6% (ASTM F2772)
   21. Energy Restitution: 66.8% (Deltec)
   22. Delta IIC: 53 (ASTM E2179)
   23. Vertical Deflection / Deformation: 0.73 mm (ASTM F2772)

24. Surface Effect Slip Resistance: Pass (ASTM F2772)
25. Vertical Ball Rebound: 99.7% (ASTM F2772)

2.3 SOURCE QUALITY

A. Source Quality: Obtain Fusion Bonded Vulcanized Composition Rubber resilient flooring materials from a single manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Broom clean or vacuum surfaces to be covered, and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

B. Grind all concrete deck ridges and imperfections greater than 1/16” down smooth and flush to the deck surface using power grinders.

C. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors to achieve flatness to a tolerance of 3/16” over 10 feet, allow to cure.

D. Perform bond and moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured, dried and ready to receive flooring. Test for pH – not to exceed 9.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

F. Safety flooring shall be installed over subfloors conforming to ASTM F710 for concrete and other monolithic floors, or ASTM F1482 for wood subfloors.

3.2 INSTALLATION

A. General:
   1. Where movable partitions are shown, install resilient flooring before partitions are erected.
   2. Install flooring using method indicated in strict compliance with manufacturer's recommendations. Extend flooring into toe spaces, door reveals, and into closets and similar openings.
   3. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
   4. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around cover and to covers.
   5. Tightly cement flooring to floor deck without open cracks, voids, raising and puckering joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll flooring at perimeter of each covered area to assure adhesion.

B. Manufacturer’s Instructions: Comply with manufacturer’s product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.

3.3 ELECTRIC CONDUCTIVITY TESTING

After installation of rubber flooring is complete, test the flooring with an ohm meter in accordance with EOS/ESD S7.1, ASTM F150, or NFPA 99.

3.4 CLEANING AND PROTECTION

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

B. Protect newly installed flooring from all foot traffic for not less than 24 hours, and protect from heavy rolling traffic for not less than 72 hours.

C. After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.

END OF SECTION

SECTION 09 65 16.23

RESILIENT VINYL SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Documents

Section Includes: This section includes labor, materials and other services necessary to complete resilient safety sheet vinyl flooring systems and accessories work. Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section, including but not limited to the following:

1. Coordination of start date and timeframe.
2. Coordination of substrate preparation.
3. Coordination of moisture and pH testing.
4. Coordination with moisture mitigation if required.
5. Coordination of proper plumbing fixtures for connections with flooring.
6. Floor installation and heat welding of all seams, horizontal and vertical.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s current printed product literature, specifications, installation instructions, including the Altro Wet Area Detailing Guide, along with field reports in accordance with Section 013300 - Submittal Procedures.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Submittal Procedures including but not limited to the following:

1. Submit a cut diagram indicating seam locations and roll direction. Use mitered seam layouts for corners when changing directions 180 degrees (e.g. when running material down corridors which bisect at a right angle), unless approved otherwise.
2. Floor Plans including notations at each drainage protrusion (drains, cleanouts, grease traps and similar items) as to the method of connection.
3. Wall caps and transition to adjacent materials.
4. IGCC Submittals: Submit manufacturer’s data for recycled content, adhesives and FloorScore compliance: include printed statement of VOC content and chemical components.

C. Samples: Submit duplicate 8" x 10" (203.2 mm x 254 mm) sample pieces of sheet material, 6" (152 mm) long in accordance with Section 01 33 00 - Submittal Procedures.

D. Closeout Submittals -Submit the following:

1. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data for incorporation into manual specified in accordance with Section 01 77 00 - Closeout Procedures. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

1. Training: Installer who has attended an Altro flooring installation training clinic or who has successfully installed Altro in three wet area installations.
2. Awarded flooring contractor must use in-house installers.

3. Awarded flooring contractor must be able to provide recent Altro references with contacts.

B. Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing.
   1. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   2. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

C. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, manufacturer's warranty requirements, and installer qualifications.

D. Bond Test: Install multiple bond tests using 3' x 3' pieces of material adhered with the appropriate adhesive to verify quality of adhesion. Remove half of each piece after 24 hours, then the other half after 48 hours. To help assess resistance to indentation, place end user equipment onto a sample for 72 hours. Document all results.

E. Regulatory Requirements: Provide safety flooring in compliance with the following:
   1. Americans with Disabilities Act Architectural Guidelines (ADAAG)
   2. Occupational Safety and Health Administration (OSHA)

1.5 SITE CONDITIONS

A. Temperature Requirements: If storage temperature is below 68F (20C) or the floor temperature is below 65F (18C), the Altro flooring must be moved to a warmer place and allowed to reach this temperature before unrolling or installation. For further information, refer to current Altro Installation Practices and Quick Facts.

B. Maintain air temperature and structural base temperature at flooring installation area between 68F (20C) and 80F (26C) for 72 hours before, during and 24 hours after installation.

C. Maintain the ambient relative humidity between 40 percent and 60 percent during installation.

D. Allow sufficient time for proper preparation, installation and curing.

E. Close spaces to traffic during resilient flooring installation until the installer is satisfied the adhesive has set.

F. Verify permanent HVAC is operational. If temporary heat is required, use electric or indirect heat sources. Do not use kerosene or propane in direct contact with the ambient air.

G. Verify other finishing operations, including painting, have been completed.

H. Where demountable partitions and other items are indicated for installation on top of sheet resilient flooring material, install flooring material before these items are to be installed.

I. Coordinate with plumbing subcontractor that approved surface membrane clamping drainage connections will be used, including but not limited to, surface clamping round drains, surface clamping trench drains, surface clamping floor sinks, surface clamping grease traps, or use of Altro Gulley Edge/Angle, or employment of Altro's Modified Surface Clamping Drain System if existing drains cannot be removed.

J. Conform to all pertinent ASTM, ACI and Altro Standards listed in, but not limited to, this specification.

1.6 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver, store and handle resilient flooring materials in accordance with manufacturer's requirements.

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

E. Store rolls in dry locations. Stand rolls on end. Protect and secure rolls from falling.

1.7 WASTE MANAGEMENT AND DISPOSAL

A. Deposit all packaging materials in appropriate container on site for recycling or reuse.

B. Avoid using landfill waste disposal procedures when recycling facilities are available.

C. Keep all discarded packaging away from children.

1.8 WARRANTY

A. Warranty period for Altro Stronghold 30 shall be 12 years commencing on date of substantial completion.

B. A Labor Warranty period of 2 years to be supplied by Sub-Contractor.

PART 2 – PRODUCTS

2.1 HEAVY DUTY SAFETY FLOORING

Safety flooring meets requirements of ASTM F1303-2, Type 2, Grade 1, Class A moisture resistant backing.

A. Heavy Duty Safety Sheet Vinyl Manufacturer: Altro, or approved equal.

1. USA: Altro USA, Incorporated. 80 Industrial Way, Wilmington MA 01887
   Toll Free: 800.377.5597 Tel: 978.657.6464 Fax: 610.746.4325
   Email: request info (support@altrofloors.com); Web:www.altrofloors.com

   Material: Altro Stronghold 30; ASTM D2047 .92 Dry, .88 Wet; Thickness: 2.5 mm (0.10"); Roll Width: 2 m (6' 7"); Roll Length: 20 m (66'); Roll Weight: 124.7 kg (275 lbs).

B. Acceptable material: Altro Stronghold 30, or approved equal
   Color to be selected from manufacturer's full range of standard colors

2.2 ACCESSORIES

A. Vinyl welding rod: Acceptable material:

1. Altro weld rod

B. Cove former: Acceptable material, sized to suit application:

1. Altro Cove former 20R - 24 mm (1") radius

C. Gulley edge: Acceptable material, vinyl, sized to suit application:

D. Cap strip: Acceptable material, vinyl, sized to suit application,

E. Subfloor Filler and Leveler: Use only gray Portland cement-based “moisture tolerant” underlayments, and patching compounds. Use for filling cracks, holes or leveling. White gypsum materials are not acceptable.

F. Metal edge strips:
1. Aluminum extruded, smooth, [mill finish] stainless steel with lip to extend over flooring.

G. Adhesives
1 Altrofix 30- 2-part polyurethane for areas prone to moisture
2 Altrofix 31- 2-part polyurethane fast set adhesive
3 MP600 – caulking adhesive for use with Altro Gulley Edge

H. Caulking: AltroMastic 100 caulking compound (color match flooring) for use where Altro floors abuts edges, skirtings, wall surfaces or where the flooring is cut around pipes and door frames.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Compliance: Comply with manufacturer’s product data, including product technical bulletins and product catalog for the specified Altro Flooring. Installation instructions found at www.altrofloors.com.

B. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

3.2 PREPARATION

A. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Verify permanent HVAC is operational. If temporary heat is required, use electric or indirect heat sources. Do not use kerosene or propane in direct contact with the ambient air.

C. Verify other finishing operations, including painting, have been completed.

D. Permanent and non-permanent markers, pens, crayons, and paint shall not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.

E. Altro Safety flooring shall be installed over subfloors conforming to ASTM F710 for concrete and other monolithic floors.

F. Always conduct moisture tests per ASTM F-2170 on all concrete slabs regardless of age or grade level. ASTM F-2170 Internal Relative Humidity (IRH) test results must not exceed 90%. Alkalinity Testing per ASTM F710 with an acceptable range of 7-9.9 pH.

G. Do not proceed with work until results of moisture condition tests are acceptable.

H. When patching, a moisture tolerant patching compound must always be used.

I. Contingency for High Moisture Readings in Concrete:
   1. If at the time of installation the moisture readings are in excess of Altro's recommendations, the General Contractor shall employ a means of Moisture Mitigation. This includes, but is not limited to, the following methods:
      a. Application of a Moisture Reduction Barrier (MRB)
      b. Temporary use of dehumidification equipment.
      c. Postponing of the flooring installation start time.
      d. A budget should be provided to the general contractor for use of an MRB

3.3 INSTALLATION

A. Installation: Install Altro flooring in accordance with the current posted Altro Installation Practices at www.altrofloors.com , Technical, Installation Guides. All seams shall be heat-welded with Altro Weldrod™ only. Failure to install Altro Safety flooring in accordance with recommended procedures will void the Altro Limited Product Warranty.

B. Wet Area Detailing Guide: can be found on our website at www.altrofloors.com, Technical, Installation Guides. The installation of Altro Stronghold 30 is a system installation. All circular drain covers must be modified in the field or specified by the architect to be Surface-Membrane Clamping Style Drains and installed per the instructions in the Altro Flooring installation guide. The Gulley Edge/Angle, AltroMastic 100, Cove Former, and Cap Strip Accessories are necessary accessories for a water-tight and manufacturer-compliant installation.

C. Drains: Fit Altro Safety flooring and mechanically fasten to drain outlets to ensure a permanent, watertight installation.
   1. New Round Drains: Install round flash clamping ring type drains to accommodate Altro safety flooring. Install drains to fit flush with surrounding floor surface. Please refer to Altro's current Installation Guide for approved drain styles, www.altrofloors.com, Technical, Installation Guides. If the drain body specified has weep holes that they be sealed so as not to allow moisture from inside the drain itself to leak back up and out of the weep holes. If Surface-Clamping Style Drains are not utilized, the drain covers must be modified to mechanically fasten flooring to drain outlets as per Altro's guidelines to drain modifications.

   2. Existing Drains: If Surface-Clamping Style Drains are not utilized, provide mechanically fastened stainless steel drain rings over all-round drain outlets as per Altro's guidelines to drain modifications. Fit rings over slip resistant sheet vinyl and permit inside diameter that will allow clean-out plate to be removed after installation. Drill into concrete to accommodate lead or plastic anchors. Screw drain rings to create a tight seal with beveled head stainless steel screws.

   3. Square and Rectangular Drains and Floor Sinks: Heat-weld Altro Gully Edge GE25RE or GE35RE (color match) around perimeter of drain which has been set in concrete in accordance with Altro Installation Guide. Do not use Altro Gully Edge around drains set in wood floors. Provide stainless steel strips, mechanically fastened with stainless steel screws. Use stainless steel strips in other areas where it is not practical to use Altro Gully Edge.

D. Coved Installation: Altro flooring should be coved up wall surfaces and other abutments, installation shall be in accordance with Altro Installation Practices using the following accessories:
   1. At standard wall finishes: Use Altro C7 vinyl cap strip to accommodate sheet vinyl to a height as indicated; adhere with contact tape.
   2. At ceramic tile, Altro Puraguard wall cladding or FRP paneling: Use Vinyl Cap Altro C8 or

C4, or Altro Stainless Steel Cap.

3. When coving up the wall; at juncture of vertical and horizontal surfaces: Use Altro Vinyl Cove Former and install with contact tape.
4. Top set cove base: Install in accordance with manufacturer's instructions.

3.4 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Never use tapes on the surface on the finish flooring. Never use Sharpies, pens, crayons or construction markers on either the finish flooring or the substrate.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Current recommended maintenance procedures can be found on the Altro website at www.altroors.com , Technical Documents, Maintenance Guides.

E. Sweep or vacuum all construction debris and dust first, then clean the flooring with AltroClean 44 /AltroClean 44 Plus using an auto scrubber.

F. Cover and protect finished installation from damage from other trades using a non-staining, temporary floor protection system, such as reusable textured plastic sheeting.

G. No traffic for 24 hours after installation, unless approved by Altro technical.

H. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

I. Wait 72 hours after installation before performing initial cleaning. Start a regular maintenance program after the initial cleaning as recommended by manufacturer.

3.5 PROTECTION

A. Cover and protect finished installation from damage from other trades using a non-staining, temporary floor protection system, such as a reusable textured plastic sheeting.

B. Altro Stronghold 30 should be covered and protected from all other trades during construction with a suitable non-staining protective covering without taping to the surface of flooring.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Provisions established within the Contract, Division 1, General Requirements, the Drawings are collectively applicable to this Section.

1.2 REFERENCE STANDARDS

A. NACE No. 6/SSPC-SP 13 – Surface Preparation of Concrete

B. ACI 308 – Standard Practice for Curing Concrete

C. ACI 302.1R-80 – Guide for Concrete Floor and Slab Construction

D. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

A. Prior to commencing work, submit manufacturer's technical information and installation details to describe materials to be used. The same manufacturer shall supply all polymer underlayments wall and floor finishes.

B. Submit manufacturer's certificate of compliance that materials meet specification requirements.

C. Before beginning work, samples of the flooring systems shall be provided for architect's approval.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Sika Corporation: 201 Polito Avenue, Lyndhurst, NJ 07071
   Phone: 201.933.8800
   Local: Jesse Haberstich – 330.760.3319 – baerstich.jesse@us.sika.com
2. No request for substitution shall be considered that would change the generic type of coating system specified (i.e., 100% reactive, Methyl Methacrylate based acrylic liquid). Equivalent materials of other manufacturer's may be substituted only on approval on the Architect or Engineer. Requests shall include the respective manufacturer's technical literature for each product giving the name, generic type, descriptive information, recommended dry film thickness (DFT), Material Safety Data Sheets (MSDS), and certified test reports showing results to equal performance criteria of products specified herein.
3. Manufacturer must show a minimum 15-year history of manufacturing MMA products for the specified application. Manufacturer must show a minimum of 10 projects of equal size and magnitude as this project.

B. Applicator Qualifications

1. Pre-qualification requirements: Each bidder for this project shall be pre-qualified and approved by the material manufacturer at the time of bid submittal. Acceptability will include judgement on equipment, history, and financial strength. In no case will Master Builders Solutions permit the application of any of its materials by untrained, non-approved Contractor or personnel.
2. Each approved applicator shall have been trained by the Manufacturer in all phases of surface preparation and application of the specified flooring systems(s). Approved

applicator must possess proper surface preparation equipment as recommended by the manufacturer.

3. Each approved applicator must have ten years experience of installing the specified flooring system and submit a list of five projects/references as a prequalification requirement. At least one of the five projects/references must be of equal size, quantity, and magnitude to this project as a prequalification requirement. Owner has the option to personally inspect the projects/references to accept or reject any of the Contractors prior to bid time as a prequalification requirement.

C. Acceptance Sample:
1. A minimum one-foot square representative sample of the specified flooring system shall be prepared by the Manufacturer's representative and submitted to the Owner prior to the bidding phase of the project. All bidders shall inspect the "acceptance sample" before submitting their bids.
2. The installed flooring system shall be similar to the acceptance sample in thicknesses of respective film layers, color, texture, overall appearance and finish.

D. Bond Testing:
1. Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system(s).
2. See paragraph 3.03 or consult with Material Manufacturer for specific procedure.

E. Pre-Job Meeting
1. Owner requires a Pre-Job Meeting with representatives of Owner, Contractor/Applicator, and Material Manufacturer in attendance. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules. Applicator is not authorized to proceed until this meeting is held or waived by Owner.

1.5 DELIVERY AND STORAGE:
1. Single source responsibility: Provide fillers, broadcast media, underlayments, and all accessory products by the same manufacturer with no less than 10 years of experience in the manufacture and supply of these principal materials for work in this section.

2. Company shall be ISO 9001: 2000 Certified.

3. No request for substitution shall be considered that would change the generic type of coating system specified (i.e., 100% reactive, Methyl Methacrylate based acrylic liquid). Equivalent materials of other manufacturer's may be substituted only on approval of the Architect or Engineer. Requests shall include the respective manufacturer's technical literature for each product giving the name, generic type, descriptive information, recommended dry film thickness (DFT), Material Safety Data Sheet (MSDS), and certified test reports showing results to equal performance criteria of products specified herein.

4. Manufacturer must show a minimum 10 year history of manufacturing MMA products for the specified application. Manufacturer must show a minimum of 10 projects of equal size and magnitude as this project.

B. Contractor Qualifications:
1. Pre-qualification requirements: Each bidder for this project shall be pre-qualified and approved by the material manufacturer at the time of bid submittal. Acceptability will include judgment on equipment, history, and financial strength. In no case will Sika Corporation permit the application of any of its materials by untrained, non-approved Contractor or personnel.

2. Each approved applicator shall have been trained by the manufacturer in all phases of surface preparation and application of the specified flooring system(s). Approved applicator must possess proper surface preparation equipment as recommended by manufacturer.
3. Each approved applicator must have ten years experience of installing the specified floor system and submit a list of five projects/references as a prequalification requirement. Contractor shall provide a letter of certification by Manufacturer that Contractor is a current qualified installer.

C. General Qualifications:
1. The finished floor coating system shall be uniform in color, texture, and appearance. All edges that terminate at walls, floor discontinuities, and other embedded items shall be sharp, uniform, and cosmetically acceptable with no thick or ragged edge. The Contractor shall work out an acceptable masking technique to ensure the acceptable finish of all edges.
2. Owner and Contractor shall review and mutually agree upon color, grade and final texture and chemical-resistant of system before starting installation.
3. Bond Testing: Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system(s).
4. Pre-Job Meeting: Owner requires a Pre-Job Meeting with representatives of Owner, Contractor/Applicator, and Material Manufacturer in attendance. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules. Applicator is not authorized to proceed until this meeting is held or waived by Owner.

1.6 DELIVERY AND STORAGE

A. Material shall be delivered to project site in Manufacturer’s original unopened containers bearing manufacturer's name, product and color.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays

C. Materials shall be stored indoors, protected from damage, moisture, direct sunlight and temperatures below 25°F or above 80° F.

1.7 PROJECT CONITIONS:

A. Evaluate the substrate condition, including moisture content and extent of substrate leveling and repairs required, if any.

B. Material, air, and surface temperatures shall be in the range of 25°F to 85°F during application and cure, unless a special formulation is being used and manufacturer has been consulted

C. Relative humidity in the specific location of the application shall be less than 85% and the surface temperature shall be at least 5 degrees above the dew point.

D. Conditions required of new concrete/CMU/cement board to be coated with MMA materials:
1. All new concrete/CMU mortar joints must be fully cured for a minimum of 28 days prior to application for the coating system pending moisture testing.
2. Surface contaminants such a curing agents, membranes, drywall mud or other bond breakers should not be used
3. Concrete mortar joint shall be struck flush to CMU face

E. Foodstuffs if they exist on site are the responsibility of the Owner and shall be removed from the area of application prior to installation.

F. Coordinate work with other trades to ensure adequate illumination, ventilation, and dust-free environment during application and curing of flooring.

G. Comply with material manufacturer's recommended temperature limitations for flooring application.

1.8 WARRANTY:

A. Contractor shall furnish a written warranty covering both material and workmanship for a period of (5) years from date of installation.

PART 2- PRODUCTS

2.1 MANUFACTURER

A. Sika Corporation USA
889 Valley Park Drive
Shakopee, MN 5537

B. Contact: Jesse Haberstich
Title: Territory Sales Manager
Phone: 330.760.3319
E-mail: haberstich.jesse@us.sika.com

2.2 MATERIALS:

A. Silkafloor Pronto 1851 SRS CF Self-Leveling Flooring System is a 3/16" thick (nominal thickness), 100% reactive Methyl-Methacrylate (MMA) based acrylic resin floor system with a decorative flake broadcast, including appropriate primer and topcoats

1. Primer:
Silkafloor Pronto SRS 41P MMA Penetrating Primer with Silkafloor Pronto SRS 103IN i-Component
2. Base Coat:
Silkafloor Pronto SRS 61BC MMA Base Coat with Silkafloor Pronto SRS 100SL filler & Silkafloor Pronto PGM 155 Base Layer Pigment
3. Broadcast:
Silkafloor Pronto DE FK Decorative Vinyl Chips; Color & Size of Flake: ¼" Limestone Flake
4. Topcoats:
Silkafloor Pronto SRS 71TC Clear MMA Topcoat; Finish: Matte, Number of Coats: Two
5. Cove Base (If Applicable):
Silkafloor Pronto SRS 100PAS Thixotropic Coving Resin; Height 6"
6. Pigment:
Silkafloor Pronto PGM 155 SRS Powder Pigment; Color: White (color to complement flake blend)

2.3 PRODUCT PERFORMANCE CRITERIA

A. Silkafloor Pronto **SRS 41P Primer/Sealer**

1.	Percentage Reactive Resin:	100%
	Percentage Solids	100%
2.	Water Absorption, Wt. % (ASTM D570):	0.06%
3.	Tensile Strength, psi (ASTM D638)	3,550
4.	Hardness (Shore D)	75
5.	Viscosity (ASTM D2393)	15-25 cps
8.	Electrical Resistivity, (ASTM D257) Volume Resistance, ohm-cm:	2.5×10^{15}
1.	Percentage Reactive Resin:	100%

	Percentage Solids	100%
2.	Water Absorption, Wt. % (ASTM D570):	0.06%

B. Silkafloor Pronto **SRS 61BC Base Coat**

1.	Percentage of reactive resin:	100%
	Percentage of solids:	100%
2.	Water Absorption, Wt. % (ASTM D570):	0.04
3.	Compressive Strength, psi (ASTM C109):	6,000-8,000
4.	Tensile Strength, psi (ASTM D638):	1,050
5.	Hardness (Shore D)	70
6.	Viscosity (ASTM D2393)	230-270 cps
7.	Coefficient of Thermal Expansion, in./in./deg. F (ASTM D696):	.000019
8.	Electrical Resistivity, (ASTM D257) Volume Resistance, ohm-cm:	10^{14}

C. Silkafloor Pronto **SRS 71TC Colorless Topcoat Resin**

1.	Percentage Reactive Resin:	100%
	Percentage Solids:	100%
2.	Water Absorption, Wt. % (ASTM D570):	0.04
3.	Compressive Strength (ASTM C109):	6,000-8,000 psi
4.	Tensile Strength, psi (ASTM D638):	1,050
5.	Tensile Modulus, psi (ASTM D638):	4.4 x 105 psi
6.	Viscosity (ASTM D2393)	230-270 cps
7.	Electrical Resistivity (ASTM D257):	
	Volume Resistance, ohm-cm:	10^{14}
8.	Water Vapor Transmission (DIN 53122) g/cm-hr-mm Hg X 10-9:	1.43

D. Chemical Resistance (all Silkafloor Pronto SRS resins)
ASTM D543:

Effect of weak acids:	none
Effect of strong acids:	slight
Effect of alkalis:	none
Effect of salt solutions:	none
Effect of oil, grease:	none
Effect of sunlight (UV radiation):	none

2.4 PRODUCT INSTALLATION & APPLICATION CRITERIA

A. All Silkafloor Pronto SRS Material Systems:

1. Pot Life at 68º F.: 10-15 minutes
2. Cure Time at 68º F.: 60 minutes
3. Recoat Time at 68º F.: 60-90 minutes

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Concrete must have a curing period of 28 days minimum. The surface must be clean and dry, physically sound and free of contamination. Surfaces must be free of holes, voids or defects. Cracks and abrupt changes in surface profile must be corrected. Any unevenness in the material surface must be removed. All curing compounds and sealers must be removed.

B. Verify that moisture content is within range acceptable to Manufacturer, using calcium chloride test kit in accordance with ASTM F-1869. Alternatively, ASTM F2170 can be used to determine the Relative Humidity within the concrete substrate.

C. Contractor must report, in writing, surfaces left in improper condition by other trades. Application will constitute acceptance of surfaces by the applicator.

3.2 PREWORK INSPECTION

A. Examine all surfaces to be coated with MMA material systems and report to the Owner and/or Engineer any conditions that will adversely affect the appearance or performance of these coating systems and that cannot be put into acceptable condition by the preparatory work specified in Paragraph 3.03.

B. Do not proceed with application until the surface is acceptable or authorization to proceed is given by the Architect and/or Engineer.

C. In the event that Applicator has employed all acceptable methods of surface preparation and cannot remedy adverse conditions that would lead to failure of the installation, Applicator shall withdraw from the contract and Owner will be financially responsible only for preparation efforts.

D. Electricity and water to be provided by Owner for use by flooring contractor.

E. Ventilation to be discussed and agreed upon by all parties prior to installation.

F. Owner shall provide means for disposal of construction waste.

G. Applicator will protect adjacent surfaces not be coated with masking and/or covers. Owner's equipment shall be protected from dust, cleaning solutions, and flooring materials. Responsible parties for protection to be discussed prior to work commencing.

3.3 PREPARATION:

A. Surface Preparation - General
   1. Prepare surfaces by shot blast, scarifying or similar mechanical method, to achieve suitable CSP as recommended by manufacturer.
   2. Patch all depressions, divots, honeycombed or scaled concrete with MMA products, as recommended by manufacturer.
   3. Concrete/CMU substrate must be clear and dry. Dislodge and remove all dirt, mortar splatter, paint overspray, and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming and/or compressed air blow-down.
   4. Durarock/James Hardie Cement Board can be used as an alternate substrate to Concrete/CMU Walls. All wall substrates must be new and clean of any contaminants such as plaster, joint compound, and paint.
   5. All unacceptable substrates must be replaced or repaired prior to application.

B. Cracks & Joints
   1. CMU mortar joints may telegraph through finished wall system/cove base.

C. Terminations
   1. Saw cut & key in MMA flooring system at all doorways, transitions to dissimilar materials, around drains, etc. All cove base/wall coatings to terminate at door frames, integral cove base or floor and/or ceiling. Details available from manufacturer upon request.

3.4 INSTALLATION:

A. Comply with flooring system Manufacturer's recommendations.

B. Primer: Mix & apply Silkafloor Pronto SRS 41P Primer with Silkafloor Pronto SRS 103IN to all floor substrates at approx. 100 square feet per gallon.

C. Basecoat: Mix & apply Silkafloor Pronto SRS 61BC with self-leveling filler and pigment with a roller for a thickness of 3/16".

D. Broadcast: Colored flake to be broadcast into the uncured/wet base coat at approx. .15 square feet per pound.

E. Topcoats: Mix & apply two topcoats of Silkafloor Pronto SRS 71TC at approx. 90-100 square feet per gallon for the first coat and 100-125 square feet per gallon for the second coat.

F. Cove Base: Where specified, install a (6") high integral cove base with a nominal 1" radius onto wall surfaces. Cove base installations should follow the standard Silkafloor Pronto SRS construction cove details.

G. Time for curing (45 - 60 minutes) shall be allowed between each coat and after final topcoat.

3.5 CLEANUP & PROTECTION

A. Remove waste materials, rubbish and debris and dispose of them in accordance with local regulations. Leave work areas in a clean condition.

B. Applicator shall remove any material spatters and other material that is not where it should be. Remove masking and covers taking care not to contaminate surrounding area.

C. Applicator shall repair any damage that should arise from either the application or clean-up effort.

D. Consideration should be given to protecting all finished areas until all other trades on the construction project are completed with their scopes of work. Floor protection should be installed in the form of a hard surface with taped seams, only after full curing of coating has occurred.

END OF SECTION

SECTION 09 68 10

CARPET TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Carpeting and carpet accessories.

1.2 QUALITY ASSURANCE

A. Installer: Firm with not less than 2 years of carpeting experience, similar to work of this section.

B. Manufacturer: Firm with not less than 5 years of production experience with carpet similar to types specified in this section; and whose published product literature clearly indicates general compliance of products with requirements of this section.

C. General Standard: "Carpet Specifier's Handbook" by the Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

1.3 SUBMITTALS

A. Product data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's recommended installation procedures which, when accepted by Architect, will become basis for accepting or rejecting actual installation procedures used on Work.
   3. Materials list of products provided under this Section.

B. Samples:
   1. Samples of carpet for acceptance and selection of color and pattern.
   2. Transition strip colors for selection by Architect

1.4 PRODUCT HANDLING

Deliver carpeting materials in protective wrapping and store inside, protected from weather, moisture and soiling.

1.5 WARRANTY

Provide special project warranty, signed by Contractor and Installer agreeing to repair or replace defective workmanship of carpeting work during 2-year warranty period following substantial completion.

1.6 MAINTENANCE MATERIAL

Deliver (12) twelve square yards of surplus material for each type of carpet, together with usable scraps of carpet to Owner's designated storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include roll ends of less than 9'-0" length, and pieces of more than 3 square feet area and more than 8" wide. Dispose of smaller pieces as "construction waste".

PART 2 - PRODUCTS

2.1 FLOOR CARPET

A. Carpet Construction:

1. Fabricate carpet by the construction method indicated as recognized in the carpet industry, using manufacturer's standard process.
2. FHA Density: Pile yarn ounce per square yard x 36, divided by average pile thickness (height); provide densities indicated.
3. Pile Thickness (Height): Average height above backing, ASTM D 418; provide thicknesses indicated.
4. Pile Face Weight: Ounce per square yard above backing; provide weights indicated.
5. Stitches or Rows: Number of rows of tufts per inch of carpet length; provide rows indicated.
6. Gage or Pitch: Gage (spacing of tufts) and pitch (number of tufts in 27") measured at each row of tufts in width of carpet; provide gages or pitches indicated.
7 Static Resistance: Provide yarn or yarn blend as indicated in carpet construction, and include provisions to comply with static resistance ratings as indicated, either by selection yarns known to be effective or by inclusion of small percentages of special anti-static yarn known to be effective in achieving indicated static resistance. Where rating is not otherwise indicated, provide 3.5 KV resistance for 20% relative humidity at 70 degrees F, AATCC 134.
8. Unitary Backing: Except as otherwise indicated, provide carpet manufacturer's standard type and weight of backing materials, as recommended for adequate strength and carpet stability without application of secondary sheet-type backing, and as appropriate for service and exposure indicated.
9. Primary Backing: Except as otherwise indicated, provide woven construction or sheet goods, of natural or synthetic fibers or non-woven sheets, as applicable to carpet construction indicated, and appropriate for service and exposures indicated.
10. Outdoor and Wet Area Carpet: Fabricate with only synthetic backing materials.
11. Back Coating: Liquid latex or polyurethane coating or manufacturer's similar equivalent coating as required for carpet stability and tuft bind as indicated. Unless otherwise indicated, provide tuft bind of not less than 8 pounds for looped pile and 6 pounds for cut pile, ASTM D 1335.
12. Tufted Carpet: Provide coating weight of not less than 15 ounce per square yard. Secondary Backing: Provide 6.0 ounce per square yard woven jute carpet backing, or provide 3.5 ounce per square yard woven synthetic fiber carpet backing. Laminate to primary backing with latex or similar adhesive recommended by manufacturer; provide a bond strength of 2 pounds per inch, Federal Test Method Standard No. 191.
13. Integral Cushion Backing: Provide type, thickness, and weight or density indicated; bonded to backing of carpet by either forming in place or laminating sheet stock; provide a bond strength of 2 pounds per inch, Federal Test Method Standard No. 191.
14. Flammability: Provide integral cushion which passes the pill test (separately from carpet), ASTM D 2859 (DOC FF-1-70); or which is rated 75 by tunnel test, ASTM E 84 (UL Test 723).

B. Selected Carpets: Unless otherwise indicated or shown match manufacturer's stock carpets as designated below for control/selection of construction, material, color, pattern and texture:

Entrance Walk Off Carpet Tile:

1.	Product Construction	Tufted Cut Pile
2.	Yarn Type	Milliken-Certified WearOn Nylon and Monofilament Type
3.	Dye Method	PrintWorks Precision Dye
4.	Tufted Face Weight	24 oz/yd^2
5.	Pile Height	0.186 inch average
7.	Stitches	9.5 per inch

8.	Pile Density	4,684 oz/ yd^2
9.	Total Thickness	.50 inch
10.	Primary Backing	PVC-Free WellBAC Comfort Plus Cushion
11.	Static Generation	3.5 KV or less
12.	Size	50cm x 50cm
13.	Acceptable Product	OBEX Cut by Milliken
14.	Style	Stipple
15.	Color	To be selected by Architect from manufacturer's full range of standard colors
16.	Install Pattern	Monolithic

C. Carpet Flammability:
1. Pill Test: Provide carpet which passes the flammability test of ASTM D 2859 (DOC FF-1-70).
2. Radiant Panel Test: In corridors and spaces of project other than individual rooms or suites, provide carpet which has been tested (with cushions in place) by the Flooring Radiant Panel Test (RFPT), NBS IR 75-950, with ratings not lower than the following:
FRPT Rating: 0.22
3. Tunnel Test: In spaces where required by code, provide carpet which has been tested (with cushions in place) by the Steiner Tunnel Test (ASTM E 84 or UL Test 723) with ratings not poorer than indicated:
Tested Ratings: Flame spread of 75, smoke density of 125

2.2 TRANSITION STRIP
A. Provide vinyl carpet edge strip at junction of floor carpet and other flooring materials where no other transition is specified. Strip type as appropriate to conditions. Colors selected by Architect from among standard colors available within the industry (any manufacturer).

B. Acceptable product: Two piece snap in vinyl 'T' molding and metal track by Johnsonite Tarkett

2.3 ACCESSORIES
A. Accessories recommended by carpeting manufacturer for proper direct glue down installation.

B. Carpet Tile Adhesive:

PART 3 - EXECUTION

3.1 PREPARATION
A. Prepare substrate in accordance with manufacturer's written procedures.

B. Grind all concrete deck ridges and imperfections greater than 1/16" down smooth and flush to the deck surface using power grinders.

C. Apply latex flash patching to all areas of the floor deck that exhibit imperfections greater than 1/16" deep.

3.2 INSTALLATION
A. General
1. Install carpet in accordance with manufacturer's installation instructions, achieving smooth surfaces, with no visible seams, and even transitions between materials.
2. Comply with manufacturer's instructions and recommendations for direction of carpet; maintain uniformity of direction and lay of pile.

3. Extend carpet under open-bottomed obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
4. Provide cut-outs where required.
5. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.

B. Glue-Down Installation; Carpet Tile:
Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps. Roll lightly to eliminate air pockets and ensure uniform bond. Remove adhesive promptly from face of carpet.

3.3 CLEANING AND PROTECTION

A. Carpet Protection Film: Contractor is to provide and install carpet shield protector film by Surface Shields over new carpeting.

B. Remove debris, sorting pieces to be saved from scraps to be disposed of.

C. Vacuum carpet using commercial machine with face beater element. Remove spots and replace carpet where spots cannot be removed.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Painting and finishing exterior and interior exposed surfaces of items provided under other Sections that are not factory-finish coated.

B. Related Work in other Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections of Division 1 of these Specifications.
2. Priming or priming and finishing of certain surfaces may be specified to be factory performed or installer performed under other Sections.

C. Work not included:
1. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except if specified.
3. Do not paint moving parts or operating units, mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts, unless otherwise indicated.
4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
5. Do not paint concrete that has been sandblasted.

D. Definitions:
1. "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.2 QUALITY ASSURANCE

A. Paint coordination:
1. Provide finish coats compatible with prime coats actually used.
2. Review other Sections of these Specifications as required, verifying prime coats to be used and assuring compatibility of total coating system for various substrata.
3. Upon request, furnish information on characteristics of specific finish materials to assure that compatible prime coats are used.
4. Provide barrier coats over non-compatible primers or remove primer and reprime as required.
5. Notify Architect in writing of anticipated problems in using specified coating systems over prime coatings supplied under other Sections.

1.3 SUBMITTALS

A. Product data:
1. Submit materials list of items to be provided under this Section if substitutions are proposed. If specified products are used, submittal is not required. Key material list to

Articles of this Section.

2. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
3. Color and finish selection kits.

1.4 JOB CONDITIONS

A. Do not apply solvent-thinned paints when temperature of surfaces to be painted and surrounding air temperatures are below 45 degrees F, unless manufacturer's printed instructions permit otherwise as approved by Architect.

B. Weather conditions:
   1. Do not apply paint in snow, rain, fog, or mist; when relative humidity exceeds 85%; to damp or wet surfaces, unless manufacturers' printed instructions permit otherwise as approved by Architect.
   2. Applications may be continued during inclement weather only within temperature limits paint manufacturer specifies as suitable for use during application and drying periods.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES

A. General:
   1. Paint colors, surface treatments, and finishes, are indicated in schedules of the contract documents.
   2. Use representative colors when preparing samples for review.
   3. Final acceptance of colors will be from samples applied on the job.

B. Color Pigments:
   1. Pure, non-fading, applicable types to suit substrates and service indicated.
   2. Paint shall contain no lead.

C. Paint Coordination:
   Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.2 MATERIAL QUALITY

A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.

D. Manufacturer's products which comply with coating qualitative requirements of applicable

Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the Architect. Furnish material data and manufacturer's certificate of performance to the Architect for any proposed substitutions.

E. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

F. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of unified system of paint finish.

2.3 COLOR SCHEDULES

A. Architect will prepare color schedule for guidance in painting. Contractor to assume field color with up to (3) accent colors.

2.4 APPLICATION EQUIPMENT

A. For application of approved paint, use only such equipment recommended for application of particular paint by manufacturer and as approved by Architect.

B. Prior to use of application equipment, verify that proposed equipment is actually compatible with material to be applied and that integrity of finish will not be jeopardized by use of proposed equipment.

2.5 OTHER MATERIALS

A. Contractor selects other materials, not specifically described but required for complete and proper installation, subject to Architect’s approval.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 MATERIALS PREPARATION

A. General:
   1. Mix and prepare paint materials in strict accordance with manufacturer’s recommendations as approved by Architect.
   2. When materials are not in use, store in tightly covered containers.
   3. Maintain containers used in storage, mixing, and application of paint in clean condition, free from foreign materials and residue.

B. Stirring:
   1. Stir materials before application, producing mixture of uniform density.
   2. Do not stir into material any film that forms on surface, but remove film and, if necessary, strain material before using.

3.3 SURFACE PREPARATION

A. Manufactured items: Follow printed instructions of manufacturer of item being finished.

B. General:
   1. Prepare and clean in strict accordance with paint manufacturer’s recommendations as approved by Architect.
   2. Remove removable items that are in place and not scheduled to receive paint finish, or

provide surface applied protection prior to surface preparation and painting operations.

3. Following completion of painting in each space or area, reinstall removed items by using workmen skilled in necessary trades.
4. Clean each surface to be painted prior to applying paint or surface treatment.
5. Remove oil and grease with clean cloths and cleaning solvent of low toxicity and flash point in excess of 200 degrees F, prior to start of mechanical cleaning.
6. Schedule cleaning and painting so that dust and other containments from cleaning process will not fall onto wet, newly painted surfaces.

C. Preparation of wood surfaces:
1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
2. Smooth finished wood surfaces exposed to view, using proper sandpaper. Where required, use varying degrees of coarseness in sandpaper to produce uniformly smooth and unmarred wood surface.
3. Unless Architect specifically approves, do not proceed with painting of wood surfaces until moisture content of wood is 12% or less as measured by moisture meter approved by Architect.

D. Preparation of metal surfaces:
1. Thoroughly clean surfaces until free from dirt, oil, and grease.
2. On galvanized surfaces, use solvent for initial cleaning and then treat surface thoroughly with phosphoric acid etch. Remove etching solution completely before proceeding.
3. Allow to dry thoroughly before application of paint.
4. Lightly sand shop applied primer on structural steel, miscellaneous exposed steel, hollow metal doors and frames, to remove burrs and un-even conditions.

3.4 PAINT APPLICATION

A. General:
1. Provide masking and protection of existing finishes and improvements from the paint application processes.
2. Touch-up damaged shop-applied prime coats, and touch-up bare area prior to applying finish coats.
3. Slightly vary color of succeeding coats. Do not apply additional coats until completed coat has been inspected and approved coats of paint will be considered in determining number of coats applied.
4. Sand and dust between coats to remove defects visible to unaided eye from distance of five feet.
5. On removable panels and hinged panels, paint back sides to match exposed sides.
6. Comply with printed instructions of manufacturer of factory-manufactured items.
7. Roller application is acceptable only on gypsum wall board or plaster wall and ceiling surfaces. All woodwork and other surfaces are to be brushed or sprayed only.
8. **Hollow Metal Doors and Frames: primer and finish coats of paint shall be applied using spray equipment only and shall achieve a smooth finish without any orange peel texture or drips.**

B. Drying:
1. Allow sufficient drying time between coats, modifying period as material manufacturer recommends, to suit adverse weather conditions.
2. Consider oil-base and oleo-resinous solvent-type paint as dry for recoating when point feels firm, does not deform or feel sticky under moderate thumb pressure, and applying another coat of paint does not cause undercoat to lift or lose adhesion.

C. Brush applications:

1. Brush out and work brush coats onto surface in even film.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.

D. Spray application:
1. Where spray application is used, apply each coat to provide hiding equivalent of brush coats.
2. Do not double back with spray equipment to build up film thickness of two coats in one pass.

E. Miscellaneous surfaces and procedures:
1. Exposed mechanical items:
a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match adjacent wall and ceiling surfaces, or as directed.
b. Paint visible duct surfaces behind vents, registers, and grilles flat black.
c. Wash metal with solvent, prime, and apply two coats of alkyd enamel.
2. Primed hardware: Paint to match adjacent surfaces
3. Interior enamel: Apply rolled finish.

3.5 COMPLETION AND CLEANING

A. Non-painted surfaces, including glass, are to be scraped clean of excess paint and putty applied as part of Work of this Contract.

B. Window sashes that operated before painting are to be operable at conclusion of Work.

3.6 PRODUCT AND SURFACE SCHEDULE

Provide following paint finishes as manufactured by the Sherwin Williams Paint company, or approved equals. Substitutions submitted for approval shall include a comparison of the specified product with the substitute product.

Ptd ‘A’: Hollow Metal Doors and Frames; semi-gloss finish
Primer: (In addition to shop applied primer): SW Pro-Industrial Pro-Cryl Universal Primer, B66-310 Series
Finish: (2) coats of SW Pro Industrial Waterbased Alkyd Urethane, B53-1150/2150 Series

Ptd ‘B’: Gypsum wallboard walls, eg-shel finish
Primer: Sherwin Williams ProMar Zero VOC Latex Primer, B28W2600
Finish: (2) coats SW ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series

Ptd ‘C’: Gypsum wallboard ceilings, flat finish
Primer: Sherwin Williams ProMar Zero VOC Latex Primer, B28W2600
Finish: (2) coats of SW ProMar 200 Zero VOC Latex Flat, B30-2600 Series

Ptd ‘D’: Metal guardrails, handrails, pipe bollards, misc metals, gloss finish
Primer: SW Pro-Industrial Pro-Cryl Universal Primer, B66-310 Series
Finish: (2) coats of SW Pro Industrial Waterbased Alkyd Urethane, B53-1150/2150 Series

Ptd ‘E’ CMU interior, high gloss
Primer: Pro Industrial Heavy Duty Block Filler
Finish: (2) coats of Pro Industrial WB Pre Catalyzed Epoxy

Ptd 'F' Wood trim, semi-gloss finish
Primer: SW PrepRite ProBlock Primer Sealer, B51-620 Series
Finish: (2) coats of SW Pro Industrial Waterbased Alkyd Urethane, B53-1150/2150 Series

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Locations of specialty signs are shown on drawings.

B. Forms of specialty signs required include the following:
   1. Interior room identification signs
   2. Exterior panel signs
   3. Exterior cast letters/numbers for building identification

1.2 QUALITY ASSURANCE

A. Uniformity Manufacturer: For each sign form and graphic image process indicated, furnish products of a single manufacturer.

B. Code Compliance: All signage shall comply with the ADA Accessibility Guidelines for Buildings and Facilities, 28 CFR Part 36.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.

B. Samples: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacture and design of each sign component including graphics.

C. Shop Drawings:
   1. Submit shop drawings for fabrication and erection of specialty signs. Include plans, elevations, and large scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template for items supported or anchored to permanent construction.
   2. Furnish full size rubbing for metal plaques.

PART 2- PRODUCTS

2.1 INTERIOR ROOM IDENTIFICATION SIGNAGE

A. General:
   1. Fabricate panel signs to comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction.
   2. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions.

B. Basis of Design: Fusion 01 Quad by Takeform

C. Sign Construction:
   1. Face Material: True metal
   2. Font: ADA Futura
   3. Raised Text Color: To be selected by Architect from manufacturer’s full range of standard colors

D. Sign Configurations:
   1. Room Name Sign

a. Size: Nominal 2.5” tall x 8.5” wide
b. Number of Rows of Copy Text: 2
c. Maximum number of characters per row: 13
d. Copy orientation: Centered
e. Provide Grade 2 braille

2. Restroom Sign
a. Size: Nominal 9” tall x 8.5” wide
b. Copy: “Restroom” as directed by Owner
c. Copy orientation: Centered
d. Provide Grade 2 braille
e. Provide universal symbols for gender and handicap accessibility

E: Mounting Hardware: Double sided vinyl tape

2.2 EXTERIOR PANEL SIGNS

A. General:
1. Fabricate exterior panel signs to comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction.
2. Produce smooth, even, level sign panel surfaces constructed to remain flat under installed conditions.

B. Unframed Signs:
1. Fabricate unframed signs with edges mechanically and smoothly finished to conform with the following requirements.
a. Edge Condition: Square cut with eased edge
b. Corner Condition: Square

C. Sign Construction:
1. Fabricate solid polymer signs from cast, filled, acrylic, not coated, laminated, or of composite construction, meeting ANSI A124. Provide contrasting copy and panel colors. Copy to be laser engraved. Applied letters and symbols are not acceptable.

D. Sign Configuration:
1. No Smoking Sign
a. Size: Nominal 16” wide x 12: tall
b. Number of rows of text: 3
c. Text: ‘SMOKING IS PROHIBITED WITHIN 25 FEET OF BUILDING ENTRANCE’
d. Text Orientation: Centered
e. Provide grade 2 braille
f. Provide universal symbol for no smoking

2.4 CAST LETTER BUILDING IDENTIFICATION SIGNAGE

A. Materials:
1. High-Grade, Pre-Finished Stainless-Steel Alloy #316
2. Material Gauge: Fabricated letters up to 24” are produced with 18 gauge faces and 24-gauge returns; letters greater than 24” are produced with 16-18 gauge faces and 22-gauge returns

B. Fabrication:
1. Cutting: All individual letters shall be computer guided laser cut from pre-finished stainless steel.

2. Construction: Letter returns shall be cut to size based on the specified letter depth and bent to the contour of the laser cut faces to produce a hollow-backed letter with 90˚ angle edges. Inside joints shall be hand-soldered with a continuous bead of lead-free silver solder. The edges of all letter faces shall have a thin line of exposed silver stainless steel.

3. Letter Depth: (return dimension): 2”

4. Text Font: Optima

5. Solid Face with no backs

6. Contractor to provide mockup sample to be reviewed by Owner and Architect before completing installation.

C. Mounting: Shadow-Free Studs
1. Letters up to 6” high: 6-32 threaded studs. Over 6” up to 24”: 10-24 threaded studs. Over 24”: 1/4-20 threaded studs. All stainless steel studs.
2. Mounting locations determined by manufacture, or per supplied art.
3. Standard stud lengths available with or without spacers. Standard suds are threaded into stud bosses, from the backs of the letters or letter returns with top or bottom stud mount.
4. Top and bottom mounts over 8” high require tie-backs (not supplied) for letter support. Optional thick back, allowing extra structural support – reduce need for tie-backs.

E. Finish: Brushed aluminum, vertical grain

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Location of signs will be determined at the time of installation as directed by the Owner.
2. Install sign units level, plumb and at height indicated, with sign surface free from distortion or other defects of appearance. See drawings for location.

B. Interior Panel Signs:
1. Wall-Mounted Units:
2. Attach signs to wall surfaces using methods indicated below:
3. Vinyl-Tape Mounting (VTM): Use double-sided foam tape, of thickness indicates, to mount signs to smooth non-porous surfaces. Do not use for vinyl-covered or rough surfaces.
4. Where signs are mounted to glass, provide a blank copy (same size and finish) on opposite side of glass to conceal back of sign and all mounting adhesives from view.

3.2 INTERIOR PANEL SIGN SCHEDULE

A. Room Name and Number Sign Quantity:
Arts & Crafts Room: 1
Conference Room: 1
Game Room: 1
Computer Lab: 1
Exercise Room: 1
Multipurpose Room: 1
Book Return: 1

Food Pantry: 1
Pantry Office: 1
Utility Room: 1
Mechanical Room: 1
Kitchen: 1
Kitchen Storage: 1
Janitor: 1
Storage: 3

B. Restroom Sign Quantity:
Women's Restroom: 1
Men's Restroom: 1
Adult Changing Restroom: 1

C. Room Number with Name Insert Quantity:
Private Offices: 2

3.3 EXTERIOR PANEL SIGN SCHEDULE
(2) No Smoking Signs (Coordinate location in field with Architect)

3.4 CAST LETTER BUILDING IDENTIFICATION SIGNAGE SCHEDULE
A. See drawings

END OF SECTION

SECTION 10 21 15

COMPOSITE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes: Composite toilet partition system, urinal screens

B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. Product data:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with specified requirements;
   3. Manufacturer's recommended installation procedures which, when approved by Architect, will become basis for accepting or rejecting actual installation procedures used on Work.

B. Shop Drawings: In sufficient detail to show fabrication, installation, anchorage, and interface of work of this Section with work of adjacent trades;

C. Color charts: Showing colors available from proposed manufacturer in specified products;

1.3 REFERENCES

A. National Fire Protection Association 101 Life Safety Code 2000 Edition, Chapters 5, 6, 8-30.

B. ANSI A 117.1-1998 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

C. International Code Council, International Building Code, 2000 Edition, Chapters 5, 7 and 8.

D. Title 24, California Code of Regulations, Parts 2, 3, and 5.

E. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.

F. Fair Housing Amendments Act of 1988, Accessibility Guidelines, Federal Register Volume 56, Number 44.

G. American Society for Testing and Materials Standards:
   1. ASTM E84-01 Standard Test Method for Surface Burning Characteristics of Building Material.
   2. ASTM D2794-93 (1999)e 1 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   3. ASTM D2197-98 (2002) Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.

4. ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance.

1.4 PERFORMANCE REQUIREMENTS

A. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, “Graffiti Removal Procedure Using Manual Solvent Rubs”:
   1. Cleanability: Five (5) required staining agents shall be cleaned off material.

B. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98 (2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:
   1. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.

C. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93 (1999)e 1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625” hemispherical indenter with 2-lb impact weight:
   1. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.

D. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
   1. Smoke Developed Index: Not to exceed 450.
   2. Flame Spread Index: Not to exceed 75.
   3. Material Fire Rating:
      a. National Fire Protection Association (NFPA): Class B.
      b. International Code Council (ICC): Class B.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer’s original unopened protective packaging.

B. Store materials in original protective packaging to prevent physical damage or wetting.

C. Handle so as to prevent damage to finished surfaces.

1.6 WARRANTY

A. Furnish ten-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.

B. Furnish one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Model numbers for toilet partitions manufactured by Scranton Products. are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions for substitutions. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

B. Toilet partitions shall be the product(s) of a single manufacturer.

2.2 MOUNTING CONFIGURATIONS

A. Toilet Partitions shall be:

1. Scranton Products 'Hiny Hider' - Overhead-Braced,
   Color: To be selected by Architect from manufacturer's full range of standard Class 'B' colors
   Texture: Orange Peel

B. Urinal Screens shall be:

1. Scranton Products 'Hiny Hider'- Wall-Hung
   Color: To be selected by Architect from manufacturer's full range of standard Class 'B' colors
   Texture: Orange Peel

2.3 COMPONENTS/MATERIALS

A. Stiles, Panels, Doors, and Screens

1. Stiles, Panels, Doors, and Screens shall be all be manufactured from Solid Color Reinforced Composite material.

B. Toilet Partition Material

1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins. Material shall have a non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.
2. Toilet partitions constructed of High-Density Polyethylene (HDPE) or High-Density Polypropylene will not be acceptable.

C. Finish Thickness

1. Stiles and doors shall be 3/4" (19 mm).
2. Panels and benches shall be 1/2" (13 mm).

D. Hardware

1. All hardware to be 18-8, type-304 stainless steel with satin finish.
2. Hardware of chrome-plated "Zamak", aluminum, or extruded plastic is unacceptable.

E. Vandal Resistant Latches

1. Sliding door latch shall be 14 gauge (2 mm) and shall slide on nylon track.
2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
3. Latch track shall be attached to door by machine screws into factory-installed threaded brass inserts.
4. Threaded brass inserts shall be factory installed for door hinge and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
5. Through bolted, stainless steel, pin-in-head Torx sex bolt fasteners shall be used at latch keeper-to-stile connections and shall withstand direct pull force exceeding 1,500 lbs. per fastener.

F. Vandal Resistant

1. Hinge shall be 16-gauge (1.6-mm) continuous piano hinge.
2. All doors shall be equipped with self-closing hinge.
3. Continuous piano hinge shall be attached to door and stile by theft resistant, pin-in-

head Torx stainless steel machine screws into factory installed, threaded brass inserts

4. Fasteners secured directly into the core are not acceptable.
5. Door shall be furnished with two 11-gauge (3-mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.
6. Door stops and hinges shall be secured with stainless steel, pin-in-head Torx machine screws into threaded brass inserts.
7. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.

G. Coat Hook
1. Coat Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29 mm) from face of door.
2. Coat hook shall be secured to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Through-bolted fasteners shall withstand a direct pull force exceeding 1,500 lbs. per fastener.
3. Provide (1) coat hook on the interior of each stall door.

H. Vandal Resistant Mounting Brackets
1. Mounting Brackets shall be 18-gauge (1.2 mm) stainless steel and extend full height of panel.
2. U-channels shall be furnished to secure panels to stiles.
3. Angle brackets shall be furnished to secure stiles to walls and panels to walls.
4. Fasteners at locations connecting panels-to-stiles shall utilize through bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.
5. Wall mounted urinal screen brackets shall be 11 gauge (3 m) double thickness.

I. Leveling Device shall be 7-gauge, 3/16" (5-mm) hot rolled steel bar; chromate treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.

J. Stile Shoe shall be one-piece, 4" (102-mm) high, type-304, 22-gauge (0.8-mm) stainless steel with satin finish. Top shall have 90° return to stile. Shoe will be composed of one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.

K. Headrail (Overhead Braced) shall be satin finish, extruded anodized aluminum (.125” / 3-mm thick) with anti-grip profile.

L. Door Style: Standard 55” height

M. Panel Edge: Shiplap

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSPECTION

A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of mounting brackets.

B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

3.3 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in work of those trades for interface with work of this Section.

B. Install work of this Section in strict accordance with original design, approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and manufacturer's recommended installation procedures as approved by Architect, anchoring all components firmly into position for long life under hard use and plumb, level, and square.

C. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.

D. Installation methods shall conform to manufacturer's recommendation for backing and proper support.

E. Conceal evidence of drilling, cutting, and fitting to room finish.

F. Maintain uniform clearance at vertical edge of doors.

3.4 ADJUSTMENT AND CLEANING

A. Adjust hardware for proper operation after installation.

B. Set hinge cam on in-swinging doors to hold doors open when unlatched.

C. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

D. Clean exposed surfaces of compartments, hardware, and fittings.

E. Touch-up scratches and abrasions to be permanently and completely invisible to unaided eye from distance of five feet.

END OF SECTION

SECTION 10 26 13

CORNER GUARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of wall and door protection devices is indicated on the drawings and includes the following:
   1. Corner guards.

1.2 QUALITY ASSURANCE

A. Manufacturer: Provide each type of wall and door protection devices as produced by a single manufacture, including anchors and accessory hardware.

B. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E84 or UL 723 by UL or another qualified testing agency.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall and door protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain temperature within storage area at not more than 90 deg F (32 deg C) during the period plastic materials are stored.
   2. Keep plastic material out of direct sunlight.
   3. Store plastic material for a minimum of 72 hours at room temperature.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products specified herein are based upon door and wall protection manufactured by TheCornerGuardStore.com.

B. Alternate, equivalent products may be proposed by the Contractor, subject to the requirements for substitutions.

2.2 MATERIALS

A. Stainless Steel, 16-gauge, type 304, satin #4 brushed finish

B. Sizes: 48”x1.5”x1.5” 90 degree

C. Model CG-SS4-18481.5-90

D. Mechanical Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Where splices occur in horizontal runs of more than 12 feet (3.66 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
      c. Adjust end returns, corners and caps as required to ensure tight seams.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION
- A. Section includes: Toilet-room accessories for public toilet rooms.

1.2 SUBMITTALS
- A. Product data:
  1. Materials list of items proposed to be provided under this Section;
  2. Manufacturer's specifications and other data needed to prove compliance with specified requirements;
  3. Manufacturer's data clearly defining required support and other details of installation to enable proper interface with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS
- A. Anchors and fasteners:
  1. Provide anchors and fasteners capable of developing retaining force commensurate with strength of accessory to be mounted and well suited for use with supporting construction.
  2. Where exposed fasteners are permitted, provide tamperproof fasteners with finish matching accessory.

2.2 TOILET-ROOM ACCESSORIES
- A. Soap Dispensers
  1. Type – Wall mounted
  2. Finish – Gray
  3. Manufacturer- GOJO 3WU72

- B. Hand Dryer
  1. Type- Wall mounted
  2. Material- Stainless steel
  3. Manufacturer: Bobrick ‘TrimLine’ B-7128

- C. Mirrors
  1. Above lavatories:
     a. Bobrick B-165/2436 snap locking, steel framed
  2. Wall mounted full length mirror
     a Bobrick B-165/2460 snap locking, steel framed

- D. Grab Bars
  1. Type - Stainless steel satin finish.
  2. Fastening - Concealed.
  3. Sizes- 18” (vertical), 36”, 42” as shown on drawings.
  4. Manufacturer – Bobrick Series B-5806.

- E. Toilet Tissue Dispensers
  1. Type – Surface mounted jumbo roll dispenser

2. Finish – Plastic, Smoke
3. Manufacturer – Georgia Pacific 4DJU7

F. Sanitary Napkin Disposal
1. Type- Wall mounted
2. Material- Stainless steel
3. Manufacturer- Bobrick 'Contura' B-270

G. Toilet Seat Cover Dispenser
1. Type – Surface mounted
2. Material- Stainless steel
3. Manufacturer – Bobrick 'Contura' B-4221

H. Waste Receptacle
1. Type – Recessed
2. Material – Stainless steel
3. Manufacturer – Bobrick 'Contura' B-43644

I. Mop and Broom Holder
1. Material- Stainless steel
2. Manufacturer – Bobrick B-223x24
3. Provide one mop/broom holder per janitor's closet

J. Coat Hooks
1. Type- Surface mounted
2. Material- Stainless steel satin finish
3. Manufacturer- Bobrick B-542

K. Paper Towel Dispenser
1. Type- Surface mounted
2. Material- Stainless steel satin finish
3. Manufacturer- Bobrick B-262

L. Surface-Mounted Adjustable Height Changing Station:
1. Basis of Design: Model KB3000-AHL as manufactured by Koala Kare Products, a Division of Bobrick.
2. Safety: Unit tested to meet ISO 60601 and ISO 17966 Unit shall have a battery backup system to safely operate changing bed in the event of a power interruption.
3. Unit designed to have redundancy by being equipped with two chains for height adjustability.
4. Emergency Stop: Unit is equipped with emergency stop to break power to actuator in an emergency
5. Powered-Height Adjustability: Electronically adjustable from 12" (300mm) to 41" (1041mm). Unit has two sets of electronic controls: located on face of wall cover; and, on front of changing bed in open, down position. Optional control pendant available for height adjustment
6. Front Safety Guard: One-hand operation. Guard shall lock in raised position along front side of changing bed. Guard shall have dip in top edge to facilitate caregiver reaching over guard to change patient. Guard shall rotate and lock under changing bed in stored position.
7. Weight Capacity: Tested to support 500 lbs (227 Kg). static load.
8. Durability: Cycle tested through range of motion 28,000 times at 500lbs. Stress tested to 100,000 cycles with 500lbs. bounce load test. Meets IK10 impact rating.

9. Cleaning: The unit shall be designed and tested to meet IPX4 rating and shall have no exposed wiring/cables for disinfecting and cleaning. Unit can be hosed without compromising the electronics
10. Frame: Shall be constructed of 2” powder coated steel tubing.
11. Changing Bed: Surface shall be 75-1/4” (1911mm) long, 31-1/2”(800mm) wide. Can be raised and lowered with one-hand. Produced from UHMW PE 1000 to be cut resistant while providing hammock for comfort. Surface shall be designed to be replaceable in the field.
12. Warranty: Three-year limited warranty on parts; one year on labor.
13. Electrical: The unit shall operate at 24V / via 120V wall outlet. It shall include a grounded power cord and have a splash proof control system rated at IPX4.
14. Optional security lap strap.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in work of those trades for interface with work of this Section.

B. Install each item in its proper location, firmly anchored into position, level and plumb, and in accordance with manufacturer’s recommendations.

END OF SECTION

SECTION 10 44 16

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: New fire extinguisher cabinets, and fire extinguishers.

B. Description: Fire extinguishers in this section refers to units which can be hand carried as opposed to those which are equipped with wheels or to fixed fire extinguishing systems, unless otherwise indicated.

1.2 QUALITY ASSURANCE

A. General: Provide portable fire extinguishers, cabinets and accessories by one manufacturer, unless otherwise acceptable to the Architect.

B. UL Listed Products: Provide new portable fire extinguishers which are UL listed and bear the UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

C. FM Listed Products: Provide new portable fire extinguishers which are approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher indicated and carry appropriate FM marking.

1.3 SUBMITTALS

A. Product data:
   1. Materials list of items proposed to be provided under this Section;
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
   3. Dimensioned drawings as needed to depict the space required for these items, and their interface with the work of other trades.
   4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:
   1. J.L. Industries
   2. Larsen's Mfg. Co.
   3. Kidde Fire Protection

2.2 FIRE EXTINGUISHERS

A. General:
   1. Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by the Architect from manufacturer's standard which comply with requirements of governing authorities.
   2. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer's requirement.
   3. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily, to type and amount of extinguishing material contained in extinguisher.

B. Multi-Purpose Dry Chemical Type: UL-rated 4-A:80-B:C, 10 pound nominal capacity, in enameled steel container for Class A, Class B and Class C fires.

2.3 FIRE EXTINGUISHER CABINETS

A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguishers of types and capacities indicated.

B. Product: JL Industries "Academy" series model 1027F10, aluminum door and trim cabinet with 2-1/2" return, semi-recessed unit with full glass door, aluminum handle, or approved equal.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

C. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

D. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

E. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

F. Where exact location of surface mounted cabinets is not indicated, locate as directed by the Architect.

G. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the Work as that Date is established by the Architect.

END OF SECTION

SECTION 10 50 20

CANOPIES

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes: Building supported, pre-engineered metal canopies including fascia channels, decking, tension rods, and attachment hardware.

1.2 REFERENCES
- A. Aluminum Association (AA)DAF 45 – Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA).
  1. 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
- C. American Society of Civil Engineers (ASCE) 7 – Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM)
  1. B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  2. B429 - Standard Specification for Aluminum-Alloy Extruded Pipe and Tube.

1.3 SYSTEM DESCRIPTION
- A. Design Requirements: Design canopy system to withstand:
  1. Standards for wind pressure, snow load, and drifting snow load in accordance with current adopted form of the uniform Construction code or accepted requirements of local municipality.

1.4 SUBMITTALS
- A. Submittals for Review:
  1. Shop Drawings: Indicate system component, dimensions, attachments, and accessories.
  2. Samples:
     a. 3x3 inch coating samples in specified color.
     b. 6 inch long fascia extrusion sample showing profile and standard finish.
     c. 6 inch decking samples showing profile and standard finish.

1.5 QUALITY ASSURNACE
- A. Installer Qualifications: Minimum 5 years experience in installation of MASA products.

PART 2 - PRODUCTS

2.1 MANUFACTURER
- A. Contract Documents are based on: Extrudeck Series
  MASA Architectural Canopies
  21 Randolph Avenue
  Avenel, NJ, 07001
  Phone 800-761-7446
  www.architecturalcanopies.com

2.2 MATERIALS
- A. Aluminum Extrusions: ASTM B221 & ASTM B429 6061-T6511 alloy and temper.

B. Hardware: All fasteners shall be (stainless steel) or (zinc coated) for corrosion resistance.

2.3 COMPONENTS

A. Framing: Type – 8" x .125" Extruded Aluminum "J" Channel (6063-T5).

B. Decking: Type – 3" x 6" x .090" Interlocking Extruded Aluminum Flat Soffit Decking (6063-T5).

C. Mounting: Type – Hanger Rod Supported, 3" x 2-½" x ¼" I-Beam Outriggers (6061-T6511) W/3/4" D Schedule 40 Steel Pipe (A500), Escutcheon Plate – 6 SQU (S).

2.4 ACCESSORIES

A. Lighting: 4" LED SQU (Standard) W/Welded Light Box, 5"x5"x1/8" Extruded Aluminum SQU Tube (6061-T6511).

B. Drainage: Down spouts 2"x3" (.032 roll formed) finish to match canopy color.

C Obscurity Screen Debris Screen Cover – Single Flange 1"x1"x1/8" Extruded Aluminum SQU Tube (6061-T6511), Fabric Ferrari Cover Soltis 86 (selected by architect from MASA color choices).

2.5 FABRICATION

A. Fabricate canopy system in accordance with approved Shop Drawings. Kit canopies to be mechanically assembled with shear stress strength as per engineering. Pre-assembled canopies are shop welded by MASA approved personnel. Drainage system to be concealed type. Covered surfaces direct water to field drilled drain, to be coordinated at site.

2.6 FINISHES

A. Aluminum:
1. Pre-Treatment: Pretreat to ASTM D1730 type B, Method 5 using a multi stage chromate process or an approved chrome-free pretreatment process approved by powder coating manufacturer for optimized weather resistance.
2. Finish Coat: AAMA 2603 Thermosetting Polyester Resin-based Powder.
3. Source: Tiger Drylac powder coating or equivalent.
4. Color: To be selected by architect from MASA color range.

PART 3 - EXECUTION

3.1 FIELD DIMENSIONS

A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.3 ADJUSTING

Touch up minor scratches and abrasions on finished surfaces to match original finish.

END OF SECTION

SECTION 11 65 00

ATHLETIC & RECREATIONAL EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION
- A. Section includes: Athletic and recreational equipment for the exercise room.

1.2 SUBMITTALS
- A. Product data:
  1. Materials list of items proposed to be provided under this Section;
  2. Manufacturer's specifications and other data needed to prove compliance with specified requirements;
  3. Manufacturer's data clearly defining required support and other details of installation to enable proper interface with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS
- A. Anchors and fasteners:
  1. Provide anchors and fasteners capable of developing retaining force commensurate with strength of accessory to be mounted and well suited for use with supporting construction.
  2. Where exposed fasteners are permitted, provide tamperproof fasteners with finish matching accessory.

2.2 ATHLETIC EQUIPMENT
- A. Mirrors
  1. Type: Standard definition, 1/4” thick tempered gym mirror with safety backing
  2. Mounting: Wall mounted with satin aluminum J bars
  2. Size: 36” x 72”
  3. Manufacturer: Activity SD Gym Mirror by Fab Glass and Mirrors, or approved equal

- B. Fitness Barre
  1. Type: Floor mounted single bar, adjustable fitness barre system with extra strength stanchions
  2. Length: 16 feet
  3. Wood type and diameter: Maple 1.5”
  4. Support finish: Black
  5. Accessories: Detachable, zippered foam cushion (full length)
  6. Manufacturer: MaximWoodADJ- 16FT- BLACK by Vita Barre, or approved equal

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS
- A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION
- A. Coordinate as required with other trades to assure proper and adequate provision in work of

those trades for interface with work of this Section.

B. Install each item in its proper location, firmly anchored into position, level and plumb, and in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 12 32 11

MANUFACTURED CASEWORK – ALL PLYWOOD

PART 1 - GENERAL

1.1 DESCRIPTION
- A. Section includes factory-fabricated kitchen cabinets

1.2 QUALITY ASSURANCE
- A. Kitchen Cabinet Standard
  1. ANSI A161.1.
  2. National Kitchen Cabinet Association (NKCA).
- B. Countertop Standard: ANSI A161.2.
- C. Field Measurements: Verify sizes and shapes of countertops prior to fabrication by field measurements taken after base cabinets are installed.

1.3 SUBMITTALS
- A. Product data: Manufacturer's specifications and installation instructions.
- B. Shop drawings: Showing all components, detail of anchorage, and interface with surrounding surfaces.
- C. Samples:
  1. Finish samples.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver until painting, wet work, grinding, and similar operations have been completed in installation areas.

1.5 JOB CONDITIONS
- A. Conditioning: Obtain temperature and humidity requirements for cabinet installation areas from manufacturer. Do not install cabinets and countertops until required temperature and relative humidity have been stabilized and will be maintained.
- B. Maintain temperature and humidity to maintain moisture content of installed cabinet work within tolerance range of optimum moisture content acceptable to cabinet manufacturer, from date of installation through Substantial Completion date.

PART 2 - PRODUCTS

2.1 MANUFACTURER
- A. Manufacturer shall be nationally recognized producer of cabinet casework, operating plant of sufficient size with necessary equipment and personnel to manufacture work in its entirety. As proof of qualification if requested by Architect, manufacturer shall submit following.
  1. List of Manufacturing Facilities.
  2. List of 10 complete jobs of comparable size.
  3. Reports by Independent Testing Laboratory covering following:
     a. Cabinet finish resistance to abrasion, acids, and reagents.
     b. Countertop finish resistance to abrasion, acids, and reagents.

2.2 KITCHEN CABINETS

A. Wall and base cabinets shall be premanufactured units, completely fabricated and ready for installation upon delivery to the jobsite. Cabinets shall be manufactured to minimum acceptable standard for construction, finish, materials and hardware equal to units fabricated by Kraftmaid Cabinetry or approved equal as follows:
   1. Door Species: Maple
   2. Door Style: Recessed panel style, “Trumbull” model
   3. Overlay: Full
   4. Kraftmaid Order Code: AJ0M6
   5. Finish: To be selected by Architect from manufacturer’s full range of standard colors
   6. Door Pull Hardware: 5/16” diameter ADA compliant stainless-steel rod drawer pulls DP55 Series by Mockett, or approved equal
   7. Door Hinge: Manufacturer’s standard chrome finished 3-way adjustable hinge cabinet and drawer.
   8. Cabinet and Drawer Construction – All Plywood Construction (APC)
      a. Face Frame: ¾” hardwood
      b. End Panel: 1/2” plywood
      c. End Panel Finish: Birch interior, matching wood veneer exterior
      d. Floor & Tops: ½” plywood
      e. Wall Back: 3/16” plywood with Birch veneer
      f. Base Back: 3/8” plywood with Birch veneer
      g. Hanging Rails: ¾” solid wood base rail, ½” solid wood wall rail
      h. Toe Kick: ½” plywood with Birch veneer
      i. Shelves: ¾” plywood with Birch veneer and edgeband-fully adjustable
      j. Shelf Clip: Satin chrome shelf rest
      k. Drawers: ¾” hardwood (4) sides with dovetail joints and 3/16” plywood floor
      l. Drawer Runner: Duraglide Plus ball bearing undermount glide with 75 lb. capacity and self closing.

2.3 COUNTERTOPS

A. Quartz Countertops installed in accordance with Section 066119 “Quartz Surfacing Fabrications”

2.4 EQUIPMENT

A. Make cutouts at manufacturing plant from approved shop drawings/data submittals for items to be installed in counter tops.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set fixed cabinets plumb. Level to lines snapped on walls between points established by Engineer's level.

B. All fastenings visible on outside of cabinets after completion of installation are to be chrome-plated steel. Fastenings to masonry walls to be flat-head sheet metal screws, 2-1/2" x 12", set in full size countersunk washers and machine driven tightly into rawl plugs so that removal by hand is impossible.

C. Fastenings between cabinets and from cabinet to countertop to be flat-head sheet metal screws, 1-1/4". Following table is to be used for fastener spacing:

		To Wall	To Top	To Adj. Cab.
a.	Wall Cabinets	2 at top		1 at top

		2 at top	1 at bottom Max. 24" OC
b.	Tall Cabinets	2 at bottom 2 at bottom	1 at top 1 at bottom Max. 24" OC
c.	Counter Cabinets (Drill through top rail of cabinet, up into countertop. Use longer screw if required.)	2 at top 18" OC 1 at bottom 1 at rear	1 @ top 1 at bottom

D. Layout of fastenings to be neat, trim, and consistent. Use sufficient quantity of fasteners to achieve firm and secure installation capable of supporting full possible load when cabinets are placed in service.

E. Sink Cabinets: Fit neatly to supply and waste lines, with hole scribed and cut to minimum possible size. Chrome-plated collars to be supplied and installed under Division 15.

F. Plumbing: Sinks to be set into neat cutout and bedded into continuous bead of 3/8 inch silicone sealer. Entire rim to show uniform break. Excess bedding compound to be wiped off wet, to leave sink top in fully clean condition.

G. Scribe Strips: Install matching trim strips at abutting walls or other construction, finished to match cabinet face wood.

H. Countertops and Splash: Install tops neatly fitted at joints and to walls at ends and back. Fasten from within cabinets per schedule. Provide continuous tops to counter-type cabinets fixed in line. Continue backsplashes at end splash at all tops terminating against wall or other piece of built-in equipment.

3.2 FINAL ADJUSTMENT

A. Final adjustment of doors and drawers to include resetting catches, latches, and locks if required to obtain accurate alignment. Cabinet hardware to be screwed tightly in place. Operating parts such as hinges and drawer glides to be siliconed or waxed for quiet squeak-free operation. Recessed bases to be butted neatly from cabinet to cabinet to permit even, unbroken line of floor covering and base.

3.3 CLEAN-UP

A. As work is completed in any one room or area, cabinet interiors are to be brushed out. Wipe with damp cloth. Wipe face wood and plastic laminate surfaces clean with damp cloth. Remove opened cartons, crating, sawdust, shavings, and debris.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Plumbing demolition.
8. Equipment installation requirements common to equipment sections.
9. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Plastic. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Equipment to Be Removed: Disconnect and cap services and remove equipment.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

H. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.

3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves or Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves or Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Bronze gate valves.
7. Iron gate valves.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221113 "Facility Water Distribution Piping" for valves applicable only to this piping.
3. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
4. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
5. Section 221423 "Storm Drainage Piping Specialties" for valves applicable only to this piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Hand lever: For quarter-turn valves NPS 6 and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

G.
1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

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. Kitz Corporation.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piee.
d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

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. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. DynaQuip Controls.
    d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    e. Hammond Valve.
    f. Jamesbury; a subsidiary of Metso Automation.
    g. Jomar International, LTD.
    h. Kitz Corporation.
    i. Legend Valve.
    j. Marwin Valve; a division of Richards Industries.
    k. Milwaukee Valve Company.
    l. NIBCO INC.
    m. Red-White Valve Corporation.
    n. RuB Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

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. Hammond Valve.
    b. Jamesbury; a subsidiary of Metso Automation.
    c. Legend Valve.
    d. Marwin Valve; a division of Richards Industries.
    e. Milwaukee Valve Company.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.

d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.3 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Lance Valves; a division of Advanced Thermal Systems, Inc.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

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. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. DynaQuip Controls.
f. Hammond Valve.
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.

c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International, Inc.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International, Inc.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.

i. Powell Valves.
j. Red-White Valve Corporation.
k. Sure Flow Equipment Inc.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE or TFE.
j. Gasket: Asbestos free.

2.7 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

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. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.

f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:

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. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded[or solder joint].
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.8 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly or gate and globe valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

1. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Throttling Service: Globe or ball or butterfly valves.
3. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.

c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 : Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 40: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze or nonmetallic disc.
3. Ball Valves: One or Two piece, full or regular or reduced port, brass or bronze with brass or bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
5. Bronze Gate Valves: Class 125, NR or RS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 : May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM or NBR seat, aluminum-bronze or ductile-iron disc.
3. weight.
4. Iron Gate Valves: Class 125, NRS or OS&Y.

3.5 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One or Two piece, full or regular or reduced port, brass or bronze with brass or bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.
4. Bronze Gate Valves: Class 125, NRS or RS.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal or nonmetallic-to-metal seats.
3. Iron Gate Valves: Class 125, NRS or OS&Y.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer**.** Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24), requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42o DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. C-Clamps (MSS Type 23): For structural shapes.
5. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.

6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
7. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

L. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inchthick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touch Up: 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

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Yellow.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Aluminum, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: White.
   b. Letter Color: Blue.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: White.
   b. Letter Color: Blue.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches square.
   b. Hot Water: 1-1/2 inches square.

2. Valve-Tag Color:

   a. Cold Water: Natural.

b. Hot Water: Natural.

3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. 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 attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

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. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

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. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.

e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

4. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.
c.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
    b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

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. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
5. Moisture Barrier for Outdoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
6. Factory-Fabricated Fitting Covers:

    a. Same material, finish, and thickness as jacket.

b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Pittsburgh Corning Corporation; Pittwrap.
b. Polyguard Products, Inc.; Insulrap No Torch 125.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with [wing seal] [or] [closed seal].

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. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

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. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. 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.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material:

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 -1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1-1/2” inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1-1/2 inches thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.13 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. Aluminum, Smooth or Corrugated or Stucco Embossed: 0.040 inch thick.

D. Piping, Exposed:

1. None.
2. Aluminum, Smooth or Corrugated or Stucco Embossed: 0.040 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC, Color-Coded by System: 30 mils thick.
3. Aluminum, Smooth or Corrugated or Stucco Embossed: 0.040 inch thick.

D. Piping, Exposed:

1. PVC: 40 mils thick.
2. Aluminum, Smooth or Corrugated or Stucco Embossed or with Z-Shaped Locking Seam: 0.032 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

B. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

C. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Architect, Construction Manager, Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Architect's, Construction Manager's, Owner's written permission.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

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

1) Viega; Plumbing & Heating Systems.

c. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
d. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

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

1) Viega; Plumbing & Heating Systems.

c. NPS 2: Wrought-copper fitting with EPDM O-ring seal in each end.
d. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

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

1) Anvil International, Inc.
2) Victaulic Company of America.

c. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

d. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.3 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:

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. EBAA Iron, Inc.
b. U.S. Pipe and Foundry Company.

3. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.
b. Expansion Required:

B. Ductile-Iron Flexible Expansion Joints:

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. EBAA Iron, Inc.
b. Hays Fluid Controls; a division of ROMAC Industries Inc.
c. Star Pipe Products.

3. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig minimum.
b. Offset
c. Expansion Required: Ductile-Iron Deflection Fittings:

4. 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:
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. EBAA Iron, Inc.

6. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

    a. Pressure Rating: 250 psig minimum.

2.4 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.5 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Manufacturing.
    b. Dresser, Inc.; Dresser Piping Specialties.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. Hays Fluid Controls; a division of ROMAC Industries Inc.
    e. JCM Industries.
    f. Smith-Blair, Inc.
    g. Viking Johnson.

2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

    a. Standard: AWWA C219.
    b. Center-Sleeve Material: Manufacturer's standard.
    c. Gasket Material: Natural or synthetic rubber.

d. Pressure Rating: 150 psig.
e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:

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. Victaulic Depend-O-Lok.

3. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

a. Standard: AWWA C219.
b. Sleeve Material: Manufacturer's standard.
c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
e. Pressure Rating: 150 psig minimum.
f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating 150 psig.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

    a. Description:

        1) Nonconducting materials for field assembly of companion flanges.
        2) Pressure Rating: 150 psig
        3) Gasket: Neoprene or phenolic.
        4) Bolt Sleeves: Phenolic or polyethylene.
        5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

    a. Description:

        1) Standard: IAPMO PS 66
        2) Electroplated steel nipple. complying with ASTM F 1545.
        3) Pressure Rating: 300 psig at 225 deg F.
        4) End Connections: Male threaded or grooved.
        5) Lining: Inert and noncorrosive, propylene.

2.6 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or a comparable product by one of the following:

    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. East Jordan Iron Works, Inc.
    f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    g. McWane, Inc.; Kennedy Valve Div.
    h. McWane, Inc.; M & H Valve Company Div.
    i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
    j. Mueller Co.; Water Products Div.
    k. NIBCO INC.
    l. U.S. Pipe and Foundry Company.

2. Non-rising-Stem, Metal-Seated Gate Valves:

    a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig.
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

3. Non-rising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

4. Non-rising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Flanged.

6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or a comparable product by one of the following:

a. American Cast Iron Pipe Co.; American Flow Control Div.
b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.

h. NIBCO INC.
i. U.S. Pipe and Foundry Company.

4. UL/FMG, Non-rising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Flanged.

5. OS&Y, Rising-Stem Gate Valves:

a. Description: Iron body and bonnet and bronze seating material.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Flanged.

C. Bronze Gate Valves:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.

4. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig.
3) End Connections: Threaded.

5. Non-rising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mueller Co. or a comparable product by one of the following:

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b. East Jordan Iron Works, Inc.
c. Flowserve.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.
h. U.S. Pipe and Foundry Company.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, non-rising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.8 CHECK VALVES

A. AWWA Check Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or a comparable product by one of the following:

a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. APCO Williamette; Valve and Primer Corporation.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.
h. McWane, Inc.; M & H Valve Company Div.
i. Mueller Co.; Water Products Div.
j. NIBCO INC.
k. Watts Water Technologies, Inc.

2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

    a. Standard: AWWA C508.
    b. Pressure Rating: 175 psig.

B. UL/FMG, Check Valves:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic or a comparable product by one of the following:

    a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    b. Crane Co.; Crane Valve Group; Stockham Div.
    c. Globe Fire Sprinkler Corporation.
    d. Kidde Fire Fighting.
    e. MATCO-NORCA, Inc.
    f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    g. McWane, Inc.; Kennedy Valve Div.
    h. Mueller Co.; Water Products Div.
    i. NIBCO INC.
    j. Reliable Automatic Sprinkler Co., Inc.
    k. Tyco Fire & Building Products.
    l. United Brass Works, Inc.
    m. Victaulic Company of America.
    n. Viking Corporation.
    o. Watts Water Technologies, Inc.

4. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.

    a. Standards: UL 312 and FMG approved.
    b. Pressure Rating: 175 psig.

2.9 DETECTOR CHECK VALVES

A. Detector Check Valves:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic or a comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Badger Meter, Inc.

c. FEBCO; SPX Valves & Controls.
d. Globe Fire Sprinkler Corporation.
e. McWane, Inc.; Kennedy Valve Div.
f. Mueller Co.; Hersey Meters.
g. Victaulic Company of America.
h. Viking Corporation.
i. Watts Water Technologies, Inc.

4. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 175 psig.
   c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

5. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.

   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 175 psig.

2.10 BUTTERFLY VALVES

A. AWWA Butterfly Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Mueller Co. or a comparable product by one of the following:

      a. DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
      b. Milliken Valve Company.
      c. Mosser Valve; a division of Olson Technologies, Inc.
      d. Mueller Co.; Water Products Div.
      e. Pratt, Henry Company.
      f. Val-Matic Valve & Manufacturing Corp.

   2. Description: Rubber seated.

      a. Standard: AWWA C504.
      b. Body: Cast or ductile iron.
      c. Body Type: Flanged.
      d. Pressure Rating: 150 psig.

B. UL Butterfly Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Mueller Co. or a comparable product by one of the following:

      a. McWane, Inc.; Kennedy Valve Div.
      b. Milwaukee Valve Company.

c. Mueller Co.; Water Products Div.
d. NIBCO INC.
e. Pratt, Henry Company.

2. Description: Metal on resilient material seating.

a. Standards: UL 1091 and FMG approved.
b. Body: Cast or ductile iron.
c. Body Type: Flanged.
d. Pressure Rating: 175 psig.

2.11 PLUG VALVES

A. Plug Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Val-Matic or a comparable product by one of the following:

a. DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
b. Homestead Valve; a division of Olson Technologies, Inc.
c. Milliken Valve Company.
d. McWane, Inc.; M & H Valve Company Div.
e. Pratt, Henry Company.
f. Val-Matic Valve & Manufacturing Corp.

2. Description: Resilient-seated eccentric.

a. Standard: MSS SP-108.
b. Body: Cast iron.
c. Pressure Rating: 175-psig minimum CWP.
d. Seat Material: Suitable for potable-water service.

2.12 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Toro Co. (The); Irrigation Division.
f. Watts Water Technologies, Inc.
g. Wilkins; a Zurn company.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: 1” NPS.
6. Design Flow Rate: 25 gpm.
7. Selected Unit Flow Range Limits: 25 gpm.

8. Pressure Loss at Design Flow Rate: 10 psig.
9. Accessories: Ball valves on inlet and outlet.

2.13 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principal Backflow Preventers:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Water Technologies, Inc.
    f. Wilkins; a Zurn company.

4. Standard: ASSE 1013.
5. Operation: Continuous-pressure applications.
6. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
7. Size: 2” NPS.
8. Design Flow Rate: 50 gpm.
9. Selected Unit Flow Range Limits: 35 gpm.
10. Pressure Loss at Design Flow Rate: 10 psig for NPS 2 and smaller; for NPS 2-1/2 and larger.
11. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
12. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
13. Configuration: Designed for horizontal, straight through, flow.
14. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Conbraco Industries, Inc.

c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Water Technologies, Inc.
f. Wilkins; a Zurn company.

4. Standard: ASSE 1015.
5. Operation: Continuous-pressure applications, unless otherwise indicated.
6. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
7. Size: 1" NPS
8. Design Flow Rate: 15 gpm.
9. Selected Unit Flow Range Limits: 25 gpm.
10. Pressure Loss at Design Flow Rate: 15 psig for NPS 2 and smaller; 5 psig for NPS 2-1/2 and larger.
11. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
12. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
13. Configuration: Designed for horizontal, straight through flow.
14. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Backflow Preventer Test Kits:

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:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Flomatic Corporation.
d. Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

4. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Aboveground Water-Service Piping NPS 3/4 to NPS 3 shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
3. NPS 1 to NPS 2 fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

F. Aboveground water-service piping NPS 4 to NPS 8 shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
4. Fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

3.2 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
2. Relief Valves: Use for water-service piping in vaults and aboveground.

    a. Air-Release Valves: To release accumulated air.
    b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
    c. Combination Air Valves: To release or admit air.

3. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.3 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Install fiberglass AWWA pipe according to AWWA M45.

J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

K. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

L. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

N. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

3.4 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
7. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

    a. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
    b. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
    c. Dielectric Fittings for NPS 5 2-1/ 2” and Larger: Use dielectric flange kits.

3.5 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

H. and valved bypass around meters unless prohibited by authorities having jurisdiction.

3.7 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.8 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.9 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water piping.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

3.12 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: 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:

1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's, Construction Manager's and Owner’s written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping, and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or comparable product by one of the following:

    a. Elkhart Products Corporation.
    b. NIBCO Inc.
    c. Viega.

3. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
4. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic or comparable product by one of the following:

a. Victaulic Company.

2. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Copper-Tube, Extruded-Tee Connections:
1. Basis-of-Design Product: Subject to compliance with requirements, provide T-Drill Ind. or comparable product by one of the following:

a. T-Drill Industries Inc.

2. Description: Tee formed in copper tube according to ASTM F 2014.

J. Appurtenances for Grooved-End Copper Tubing:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic or comparable product by one of the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: tube.

C. Color: Black.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Viking or comparable product by one of the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Piping Specialties Products.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc.; a Sensus company.
g. Viking Johnson.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Hart Industries International, Inc.

d. Jomar International.
e. Matco-Norca.
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

3. Standard: ASSE 1079.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic or comparable product by one of the following:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers outlet piping from each water heater.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or union..

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2 : 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

H. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2 : 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast copper, solder-joint fittings; and soldered joints.
3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.
5. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
6. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
7. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 and NPS 2 CPVC pipe with CPVC socket fittings may be used instead of tubing.
8. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint, copper-tube appurtenances; and grooved joints.

4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
6. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
7. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
8. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

G. Aboveground domestic water piping, NPS 5 to NPS 8, shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint, copper-tube appurtenances; and grooved joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
4. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
5. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
6. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
7. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

H. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Drain valves.
10. Water-hammer arresters.
11. Air vents.
12. Trap-seal primer valves.
13. Trap-seal primer systems.
14. Specialty valves.
15. Flexible connectors.
16. Water meters.

B. Related Requirements:
1. Section 221116 "Domestic Water Piping" for water meters.
2. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping, and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Cash Acme; a division of Reliance Worldwide Corporation.
    c. Conbraco Industries, Inc.
    d. FEBCO; a division of Watts Water Technologies, Inc.
    e. Rain Bird Corporation.
    f. Toro Company (The); Irrigation Div.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1001.
4. Size: NPS 1/4 to NPS 3, as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Cash Acme; a division of Reliance Worldwide Corporation.
    b. Conbraco Industries, Inc.
    c. FEBCO; a division of Watts Water Technologies, Inc.
    d. Honeywell International Inc.
    e. Legend Valve.
    f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1012.
4. Operation: Continuous-pressure applications.
5. Size: NPS 1/2.
6. Body: Bronze.
7. End Connections: Solder joint.
8. Finish: Rough bronze.

B. Reduced-Pressure-Principal Backflow Preventers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Conbraco Industries, Inc.
    c. FEBCO; a division of Watts Water Technologies, Inc.
    d. Flomatic Corporation.
    e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1013.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 12 psig maximum, through middle third of flow range.
6. Size: 2”
7. Design Flow Rate: 41.0 GPM
8. Pressure Loss at Design Flow Rate: 5ft/100ft
9. Body: Bronze for NPS 2 and smaller
10. End Connections: Threaded for NPS 2 and smaller.
11. Configuration: Designed for horizontal, straight-through flow.
12. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

C. Backflow-Preventer Test Kits:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; a division of Watts Water Technologies, Inc.
    c. Flomatic Corporation.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Corporation; Bell & Gossett Div.
    d. NIBCO Inc.
    e. TAC.
    f. TACO Incorporated.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
4. Body: Brass.
5. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
6. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. Armstrong International, Inc.
    b. Flo Fab Inc.
    c. ITT Corporation; Bell & Gossett Div.
    d. NIBCO Inc.

e. TAC.
f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
4. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard or comparable product by one of the following:

a. Cash Acme; a division of Reliance Worldwide Corporation.
b. Conbraco Industries, Inc.
c. Honeywell International Inc.
d. Lawler Manufacturing Company, Inc.
e. Leonard Valve Company.
f. Powers; a division of Watts Water Technologies, Inc.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

3. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
4. Pressure Rating: 125 psig minimum unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough or chrome-plated bronze.
9. Tempered-Water Setting: 140 deg F
10. Tempered-Water Design Flow Rate: 2.0 gpm
11. Hot-Water Inlet Size: ½" NPS
12. Valve Finish : rough bronze

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.8 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products.
   i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: Metal bellows.
5. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.9 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.10 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or comparable product by one of the following:

    a. MIFAB, Inc.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Smith or comparable product by one of the following:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

3. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
4. Size: NPS 1-1/4 minimum.
5. Material: Chrome-plated, cast brass.

2.11 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section 220523 "General-Duty Valves for Plumbing Piping."

B. CPVC Union Ball Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco Inc. or comparable product by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. NIBCO Inc.
h. Spears Manufacturing Company.
i. Thermoplastic Valves Inc.

3. Description:

a. Standard: MSS SP-122
b. Pressure Rating and Temperature: 125 psig at 73 deg F
c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
f. End Connections for Valves NPS 2-1/2 to NPS 4 : Detachable,
g. Ball: CPVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

C. PVC Union Ball Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. Jomar International.
h. KBI Company.
i. Legend Valve.
j. McDonald, A. Y. Mfg. Co.

k. NIBCO Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.

3. Description:

a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 150 psig (1035 kPa) at 73 deg F (23 deg C) .
c. Body Material: PVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable,] socket or threaded.
g. Ball: PVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

D. PVC Non-Union Ball Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. Jomar International.
h. KBI Company.
i. Legend Valve.
j. McDonald, A. Y. Mfg. Co.
k. NIBCO Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.

3. Description:

a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig 73 deg F
c. Body Material: PVC.
d. Body Design: Non-union type.
e. End Connections: Socket or threaded.
f. Ball: PVC; full or reduced port.
g. Seals: PTFE or EPDM-rubber O-rings.
h. Handle: Tee shaped.

E. CPVC Butterfly Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

    a. Georg Fischer LLC; GF Piping Systems.
    b. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
    c. NIBCO Inc.
    d. Spears Manufacturing Company.
    e. Thermoplastic Valves Inc.

3. Description:

    a. Pressure Rating and Temperature: 125 psig 73 deg.
    b. Body Material: CPVC.
    c. Body Design: Lug or wafer type.
    d. Seat: EPDM rubber.
    e. Seals: PTFE or EPDM-rubber O-rings.
    f. Disc: CPVC.
    g. Stem: Stainless steel.
    h. Handle: Lever.

F. PVC Butterfly Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

    a. American Valve, Inc.
    b. Asahi/America.
    c. Colonial Engineering, Inc.
    d. Georg Fischer LLC; GF Piping Systems.
    e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
    f. IPEX.
    g. Legend Valve.
    h. NIBCO Inc.
    i. Spears Manufacturing Company.
    j. Thermoplastic Valves Inc.

3. Description:

    a. Pressure Rating and Temperature: 125 psig at 73 deg F <Insert temperature>.
    b. Body Material: PVC.
    c. Body Design: Lug or wafer type.
    d. Seat: EPDM rubber.
    e. Seals: PTFE or EPDM-rubber O-rings.
    f. Disc: PVC.
    g. Stem: Stainless steel.
    h. Handle: Lever.

G. CPVC Ball Check Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

    a. American Valve, Inc.
    b. Asahi/America.
    c. Colonial Engineering, Inc.
    d. Georg Fischer LLC; GF Piping Systems.
    e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
    f. IPEX.
    g. NIBCO Inc.
    h. Spears Manufacturing Company.
    i. Thermoplastic Valves Inc.

3. Description:

    a. Pressure Rating and Temperature: 125 psig at 73 deg F.
    b. Body Material: CPVC.
    c. Body Design: Union-type ball check.
    d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded
    e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket, threaded or flanged
    f. Ball: CPVC.
    g. Seals: EPDM- or FKM-rubber O-rings.

H. PVC Ball Check Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Nibco or comparable product by one of the following:

    a. American Valve, Inc.
    b. Asahi/America.
    c. Colonial Engineering, Inc.
    d. Georg Fischer LLC; GF Piping Systems.
    e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
    f. IPEX.
    g. Legend Valve.
    h. NIBCO Inc.
    i. Spears Manufacturing Company.
    j. Thermoplastic Valves Inc.

3. Description:

    a. Pressure Rating and Temperature: 125 psig at 73 deg F.
    b. Body Material: PVC.
    c. Body Design: Union-type ball check.

d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket, threaded or flanged.
f. Ball: PVC.
g. Seals: EPDM- or FKM-rubber O-rings.

I. CPVC Gate Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Spears or comparable product by one of the following:

a. Georg Fischer LLC; GF Piping Systems.
b. Spears Manufacturing Company.

3. Description:

a. Pressure Rating and Temperature: 125 psig at 73 deg F.
b. Body Material: CPVC.
c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 and Smaller: Socket or threaded
e. End Connections for Valves NPS 2-1/2 to NPS 4 : Socket, threaded or flanged.
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

J. PVC Gate Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Spears or comparable product by one of the following:

a. Asahi/America.
b. Georg Fischer LLC; GF Piping Systems.
c. KBI Company.
d. Spears Manufacturing Company.

3. Description:

a. Pressure Rating and Temperature: 125 psig at 73 deg F.
b. Body Material: PVC.
c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 and Smaller: Socket or threaded
e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket, threaded or[Flanged].
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex or comparable product by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

C. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2and Larger: Flanged copper alloy.

D. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves[and bypass with globe valve]. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. Install air vents at high points of water piping.

J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

K. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

L. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principal backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.
7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.

8. Double-check, detector-assembly backflow preventers.
9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water mixing-valve assemblies.
13. Photographic-process, thermostatic, water mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
2. Waste, Force-Main Piping: 50 psig (345 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1. Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's, Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hub-less, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hub-less-Piping Couplings:

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. ANACO-Husky.
    b. Dallas Specialty & Mfg. Co.
    c. Fernco Inc.
    d. Matco-Norca, Inc.
    e. MIFAB, Inc.
    f. Mission Rubber Company; a division of MCP Industries, Inc.
    g. Stant.
    h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stops.

D. Heavy-Duty, Hub-less-Piping Couplings:

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. ANACO-Husky.
    b. Clamp-All Corp.
    c. Dallas Specialty & Mfg. Co.
    d. MIFAB, Inc.
    e. Mission Rubber Company; a division of MCP Industries, Inc.
    f. Stant.
    g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stops.

E. Cast-Iron, Hub-less-Piping Couplings:

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. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stops.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

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. Anvil International; a subsidiary of Mueller Water Products, Inc.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products.
   d. Victaulic Company.

2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
3. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

2.5 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.6 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

C. Ductile-Iron, Grooved-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51 with round-cut-grooved ends according to AWWA C606.
2. Ductile-Iron-Pipe Appurtenances:

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) Anvil International.
2) Shurjoint Piping Products.
3) Star Pipe Products.
4) Victaulic Company.

b. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings and complying with AWWA C606 for grooved ends.
c. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.7 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M (ASTM B 88M, Type B and Type C), water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.8 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.9 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:

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) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
w.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, No-npressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

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) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) EBAA Iron, Inc.
4) JCM Industries, Inc.
5) Romac Industries, Inc.
6) Smith-Blair, Inc.; a Sensus company.
7) The Ford Meter Box Company, Inc.
8) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

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) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Hart Industries International, Inc.
4) Jomar International Ltd.
5) Matco-Norca, Inc.
6) McDonald, A. Y. Mfg. Co.
7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
8) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

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) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Matco-Norca, Inc.
4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
5) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

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) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig (1035 kPa).
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

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) Elster Perfection.
2) Grinnell Mechanical Products.
3) Matco-Norca, Inc.

4) Precision Plumbing Products, Inc.
5) Victaulic Company.

b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

R. Install aboveground ABS piping according to ASTM D 2661.

S. Install aboveground PVC piping according to ASTM D 2665.

T. Install underground ABS and PVC piping according to ASTM D 2321.

U. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

V. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

X. Install force mains at elevations indicated.

Y. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

AA. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: [Unshielded[Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples and unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4. Use dielectric flanges flange kits and nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:
1. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet. MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3 : 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5 : 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8 : 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12 : 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 : 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2 : 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 : 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5 : 12 feet with 5/8-inchrod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12 : 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 : 84 inches with 3/8-inch rod.
2. NPS 3 : 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6 : 10 feet with 5/8-inch rod.

J. Install supports for vertical stainless-steel piping every 10 feet.

K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 : 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2 : 96 inches with 3/8-inch rod.
3. NPS 2-1/2 : 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5 : 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8 : 10 feet with 3/4-inch rod.

L. Install supports for vertical copper tubing every 10 feet .

M. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 : 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8 : 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

N. Install supports for vertical ABS and PVC piping every 48 inches.

O. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.
6. Solid-wall -core] ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

8. Dissimilar Pipe-Material Couplings: Unshielded or Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be[any of] the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI or heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Solid-wall-core] orPVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPIeavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 : Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.

6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
   Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
7. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller range shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed. calking materials; and calked] joints.
2. Hubless, cast-iron soil pipe and fittings;
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

4. Dissimilar Pipe-Material Couplings: Unshielded, Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:

1. Hard or Soft copper tube, Type L; wrought copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:

1. Hard copper tube, Type L: wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Air-admittance valves.
5. Roof flashing assemblies.
6. Through-penetration firestop assemblies.
7. Miscellaneous sanitary drainage piping specialties.
8. Flashing materials.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 334100 "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that accessories, and components will withstand seismic forces defined in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
    1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

        a. Josam Company; Josam Div.
        b. MIFAB, Inc.

c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
g. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material, cast-iron soil pipe T-branch, as required to match connected piping.
5. Closure: Countersunk or raised-head plastic plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Light Commercial Operation.
h. Zurn Plumbing Products Group; Specification Drainage Operation.
i. Josam Company; Josam Div.
j. Kusel Equipment Co.
k. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
l. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.3.1.

3. Size: Same as connected branch.
4. Housing: Stainless steel.
5. Closure: Stainless steel with seal.
6. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts :
1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts or a comparable product by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; d of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage pipin.
4. Body: Hubless, cast-iron soil pipe test tee] as required to match connected piping.
5. Closure: Countersunk or raised-head plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round,nickel-bronze, copper-alloy, or stainless-steel

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or a comparable product by one of the following:

a. Commercial Enameling Co.
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products Inc.
h. Zurn Plumbing Products Group; Light Commercial Operation.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Provide as indicated oin floor drain schedule on the drawings.

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

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. Ayrlett, LLC.
b. Durgo, Inc.
c. Oatey.
d. ProSet Systems Inc.
e. RectorSeal.
f. Studor, Inc.

3. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
4. Housing: Plastic.
5. Operation: Mechanical sealing diaphragm.
6. Size: Same as connected fixture or branch vent piping.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

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. ProSet Systems Inc.

3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

2.7 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

G. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

H. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

I. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Install fixture air-admittance valves on fixture drain piping.

K. Install stack air-admittance valves at top of stack vent and vent stack piping.

L. Install air-admittance-valve wall boxes recessed in wall.

M. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

N. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

O. Assemble open drain fittings and install with top of hub 2 inches above floor.

P. Install deep-seal traps on floor drains and other waste outlets, if indicated.

Q. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

R. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

S. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

T. Install vent caps on each vent pipe passing through roof.

U. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

V. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

W. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

X. Install wood-blocking reinforcement for wall-mounting-type specialties.

Y. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices.

END OF SECTION

SECTION 22 14 23

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Miscellaneous storm drainage piping specialties.
2. Cleanouts.
3. Backwater valves.
4. Trench drains.
5. Channel drainage systems.
6. Through-penetration firestop assemblies.
7. Flashing materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Floor Cleanouts:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or comparable product by one of the following:

a. Josam Company.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.
e. Tyler Pipe.
f. Watts Water Technologies, Inc.
g. Zurn Plumbing Products Group; Light Commercial Products Operation.
h. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.36.2M, for adjustable housing, cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanouts.
4. Size: Same as connected branch.
5. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule, adjustable housing.
6. Body or Ferrule Material: Cast iron.
7. Closure : Cast-iron plug
8. Adjustable Housing Material: Cast iron.
9. Frame and Cover Material and Finish: Painted cast iron
10. Frame and Cover Shape: Square.
11. Top-Loading Classification: Light Duty
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to clean out.

B. Test Tees:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or comparable product by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
4. Size: Same as connected drainage piping.
5. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hub-less, cast-iron soil-pipe test tee as required to match connected piping.
6. Closure Plug: Countersunk.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or comparable product by one of the following:

a. Josam Company.

b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
4. Size: Same as connected drainage piping.
5. Body Material **Hubless, cast-iron soil-pipe test tee** as required to match connected piping
6. Closure: **Countersunk or raised-head cast-iron** plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
9. Wall Access: **Round nickel-bronze, copper-alloy, or stainless-steel**> wall-installation frame and cover.

2.2 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or comparable product by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.14.1, for backwater valves.
4. Size: Same as connected piping.
5. Body Material: Cast iron.
6. Cover: Cast iron with bolted or threaded access check valve.
7. End Connections: hubless
8. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
9. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Cast-Iron, Drain-Outlet Backwater Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn or comparable product by one of the following:

a. Josam Company.

b. Smith, Jay R. Mfg. Co.
c. Watts Water Technologies, Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Size: Same as floor drain outlet.
4. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
5. Check Valve: Removable ball float.
6. Inlet: Threaded.
7. Outlet: Threaded or spigot.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Pro-Set or comparable product by one of the following:

a. ProSet Systems Inc.

3. Standard: ASTM E 814, for through-penetration firestop assemblies.
4. Certification and Listing: [Intertek Testing Service NA] <Insert testing agency acceptable to authorities having jurisdiction> for through-penetration firestop assemblies.
5. Size: Same as connected pipe.
6. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
7. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
8. Special Coating: Corrosion resistant on interior of fittings.

2.4 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Downspouts shall connect to existing below grade stormwater piping.

B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install horizontal backwater valves in floor with cover flush with floor.

F. Install drain-outlet backwater valves in outlet of drains.

G. Install test tees in vertical conductors and near floor.

H. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

I. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

K. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

A. Faucets for lavatories and sinks.
B. Toilet seats.
C. Fixture supports.
D. Water closets.
E. Lavatories.
F. Service sinks.

B. Related Sections include the following:
A. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

A. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
B. Plastic Sinks: ANSI Z124.6.
C. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
D. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
E. Vitreous-China Fixtures: ASME A112.19.2M.
F. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

A. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
B. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
C. Faucets: ASME A112.18.1.
D. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
E. NSF Potable-Water Materials: NSF 61.
F. Pipe Threads: ASME B1.20.1.
G. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
H. Supply Fittings: ASME A112.18.1.
I. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

A. Atmospheric Vacuum Breakers: ASSE 1001.
B. Brass and Copper Supplies: ASME A112.18.1.
C. Dishwasher Air-Gap Fittings: ASSE 1021.
D. Manual-Operation Flushometers: ASSE 1037.
E. Plastic Tubular Fittings: ASTM F 409.
F. Brass Waste Fittings: ASME A112.18.2.
G. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   A. Flexible Water Connectors: ASME A112.18.6.
   B. Grab Bars: ASTM F 446.
   C. Hose-Coupling Threads: ASME B1.20.7.
   D. Hot-Water Dispensers: ASSE 1023 and UL 499.
   E. Off-Floor Fixture Supports: ASME A112.6.1M.
   F. Pipe Threads: ASME B1.20.1.
   G. Plastic Toilet Seats: ANSI Z124.5.
   H. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Refer to the plumbing drawings for PLUMBING FIXTURE SCHEDULE and specifications.

2.2 FIXTURE SUPPORTS

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

   A. Josam Company.
   B. MIFAB Manufacturing Inc.
   C. Smith, Jay R. Mfg. Co.
   D. Tyler Pipe; Wade Div.
   E. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
   F. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Lavatory Supports, :

   A. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
   B. Accessible-Fixture Support: Include rectangular steel uprights.

C. Sink Supports:

   A. Description: Type I, sink carrier with exposed arms and tie rods II, sink carrier with hanger plate, bearing studs, and tie rod III, sink carrier with hanger plate and exposed arms for sink-type fixture. Include steel uprights with feet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

   A. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   B. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   C. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install toilet seats on water closets.

K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install traps on fixture outlets.

   A. Exception: Omit trap on fixtures with integral traps.
   B. Exception: Omit trap on indirect wastes, unless otherwise indicated.

O. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 47 13

DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes drinking fountains and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

A. Drinking Fountains Stainless steel, wall mounted.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay or comparable product by one of the following:

a. Elkay Manufacturing Co.
b. Filtrine Manufacturing Company.
c. Halsey Taylor.
d. Haws Corporation.
e. Elkay Manufacturing Co.
f. Filtrine Manufacturing Company.
g. Halsey Taylor.

h. Haws Corporation.
i. Murdock-Super Secur; a division of Acorn Engineering Company.
j. Stern-Williams Co., Inc.
k. Tri Palm International, LLC; Oasis Brand.
l. Tri Palm International, LLC; Sunroc Brand.
m. Crane Plumbing, L.L.C.
n. Haws Corporation.
o. Kohler Co.

3. Standards:

a. Comply with ASME A112.19.3/CSA B45.4.
b. Comply with NSF 61.

4. Receptor Shape: Rectangular.
5. Back Panel: Stainless-steel wall plate behind drinking fountain.
6. Bubblers: One, with adjustable stream regulator, located on deck.
7. Control: Push bar.
8. Drain: Grid type with NPS 1-1/4 tailpiece.
9. Supply: NPS 3/8 with shutoff valve.
10. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
11. Support: ASME A112.6.1M, Type III lavatory carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install recessed drinking fountains secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer**.**

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 : 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14 : 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24 : 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 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 a 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.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of no insulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 , with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
1. Building Classification Category: I .
2. Minimum 10 lb/sq. ft. multiplied by the 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.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: A.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC.

a. Component Importance Factor: 1.0.
b. Component Response Modification Factor: 1.5
c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods 0.2 Second):
4. Design Spectral Response Acceleration at 1-Second Period.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria,

including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.

8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

D. Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

E. Mounts Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

F. Restrained Mounts All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

G. Spring Isolators : Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

H. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

I. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

J. Elastomeric Hangers : Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

K. Spring Hangers : Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

L. Spring Hangers with Vertical-Limit Stop : Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

M. Pipe Riser Resilient Support : All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

N. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

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:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. Restraint Cables: ASTM A 603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 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.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Equipment Location:
2. Pads:

    a. Material: Neoprene
    b. Thickness: inches (mm).

3. Isolator Type designation used in Part 2.
4. Base Type: used in Part 2.
5. Minimum Deflection inches (mm).
6. Component Importance Factor: 1.0.
7. Component Response Modification Factor: 1.5.
8. Component Amplification Factor: 1.0.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having predrilled holes for attachment hardware.
2. letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretension Pipe Labels: Pre coiled, semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting"

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Black.
b. Letter Color: White.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner manager.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's

"HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation" .

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound IP units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus, or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:

      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.

   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:

      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Duct, outlet, and inlet sizes.
   3. Terminal units.
   4. Balancing stations.
   5. Position of balancing devices.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1. from Various Sources Using Small-Scale Environmental Chambers."

B. 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 insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and

adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.

c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a1 hour fire rating by an NRTL acceptable to authorities having jurisdiction.

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. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for ducts.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
   b. Vimasco Corporation; Elastafab 894.
   c. Field Applied Jackets

B. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

C. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

D. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft.
5. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

E. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

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. Polyguard Products, Inc.; Alumaguard 60.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    c. Compac Corporation; 120.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, wide with closed seal.

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. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
        2) GEMCO; Perforated Base.
        3) Midwest Fasteners, Inc.; Spindle.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
    c. Spindle: Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
    d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements,available products that may be incorporated into the Work include, but are not limited to, the following

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements **available products** that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle Stainless stee], fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

    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) GEMCO.
        2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

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. C & F Wire.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. 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.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches. .

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section 078400 “Firestopping” for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 Firestopping".

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate

duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for **100** percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) nominal density. Use 2” insulation for ductwork in crawl space or attic.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) nominal density. Use 2” insulation for ductwork in crawl space or attic.

C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) nominal density.

D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) nominal density.

E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket 3 inches (75 mm nominal density.

F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 3 inches (75 mm) nominal density.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.
2. Aluminum, Smooth: [0.016 inch (0.41 mm) thick.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig.

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

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. OmegaFlex, Inc.
b. Parker Hannifin Corporation; Parflex Division.
c. Titeflex.
d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index:25 or less.
2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig .

C. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) .

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper fittings with long nuts.
b. Metal-to-metal compression seal without gasket.
c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

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. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

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. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

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. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

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. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. ASCO Power Technologies, LP; Division of Emerson.
    b. Dungs, Karl, Inc.
    c. Eclipse Combustion, Inc.
    d. Goyen Valve Corp.; Tyco Environmental Systems.
    e. Magnatrol Valve Corporation.
    f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
    g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

3. Pilot operated.
4. Body: Brass or aluminum.
5. Seats and Disc: Nitrile rubber.
6. Springs and Valve Trim: Stainless steel.
7. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
8. NEMA ICS 6, Type 4, coil enclosure.
9. Normally closed.
10. Visual position indicator.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Vanguard Valves, Inc.

3. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
4. Maximum Operating Pressure: 5 psig.
5. Cast-aluminum body with nickel-plated chrome steel internal parts.
6. Nitrile-rubber valve washer.
7. Sight windows for visual indication of valve position.
8. Threaded end connections complying with ASME B1.20.1.
9. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings or comparable product by one of the following:

a. Pacific Seismic Products, Inc.

3. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
4. Maximum Operating Pressure: 0.5 psig.
5. Cast-aluminum body with stainless-steel internal parts.
6. Nitrile-rubber, reset-stem o-ring seal.
7. Valve position, open or closed, indicator.
8. Composition valve seat with clapper held by spring or magnet locking mechanism.
9. Level indicator.
10. End Connections: Threaded for valves NPS 2 and smaller.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawingsor comparable product by one of the following:

a. Actaris.
b. American Meter Company.
c. Eclipse Combustion, Inc.
d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
e. Invensys.
f. Maxitrol Company.
g. Richards Industries; Jordan Valve Div.

3. Body and Diaphragm Case: Cast iron or die-cast aluminum.
4. Springs: Zinc-plated steel; interchangeable.
5. Diaphragm Plate: Zinc-plated steel.
6. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
7. Orifice: Aluminum; interchangeable.
8. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
9. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
10. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Overpressure Protection Device: Factory mounted on pressure regulator.

12. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
13. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

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]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawing or comparable product by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

3. Body and Diaphragm Case: Die-cast aluminum.
4. Springs: Zinc-plated steel; interchangeable.
5. Diaphragm Plate: Zinc-plated steel.
6. Seat Disc: Nitrile rubber.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
10. Maximum Inlet Pressure: 1 psig.

2.8 DIELECTRIC UNIONS

A. Dielectric Unions:

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. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 125 psig minimum at 180 deg F
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.2 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.3 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.4 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2 : Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.5 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.6 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.7 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
2. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.9 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be[one of] the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper copper tube with wrought-copper fittings and [brazed] [flared] joints.
3. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be[one of] the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be[one of] the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.10 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground: PE valves.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, regular-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, regular]-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

C. Valves in branch piping for single appliance shall be[one of] the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 231123

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.
5. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

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 indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"**.**

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachmen, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports] AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.] [AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

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."See "Static-Pressure Classes" and "Leakage and Seal Classes" articles in the Evaluations for discussion on fabrication.

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2.2 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: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. 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.

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by[an evaluation service member of the ICC Evaluation Service.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories

for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections] [Reinforcing steel angle clamped] to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts 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. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 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.

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 (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. 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.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 DUCT CLEANING

A. Clean new duct system(s) 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 233300 "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. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

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, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. 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. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :

a. Pressure Class: Positive 2-inch wg .
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12 .
d. SMACNA Leakage Class for Round and Flat Oval: 12 [.

2. Ducts Connected to Constant-Volume Air-Handling Units :

a. Pressure Class: Positive 2-inch wg .
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.
e.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg
b. Minimum SMACNA Seal Class: A
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units :

a. Pressure Class: Positive or negative 2-inch wg .
b. Minimum SMACNA Seal Class: A
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval:

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative[2-inch wg (500 Pa.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3 .
d. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.

b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units :

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6 .
d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6 .
d. SMACNA Leakage Class for Round and Flat Oval: 3 .

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units

a. Pressure Class: Positive or negative 1-inch wg
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units :

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg .
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3 .
d. SMACNA Leakage Class for Round and Flat Oval: 3.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: [Galvanized steel
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

END OF SECTION 233113

SECTION 23 31 19

HVAC CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Factory-fabricated, field-assembled, single-wall casings for HVAC equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Casings shall be fabricated to withstand 133 percent of the indicated static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot of width.

a. Fabricate outdoor casings to withstand wind load of 15 lbf/sq. ft. and snow load of 30 lbf/sq. ft.

B. Seismic Performance: HVAC casings shall withstand the effects of earthquake motions determined according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" .

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1. Duct-Cleaning Test Report for Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
2. Product Data: For adhesives and sealants, documentation including a printed statement of VOC content.
3. Laboratory Test Reports For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Shop Drawings: For HVAC casings. Include plans, elevations, sections, components, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 GENERAL CASING FABRICATION REQUIREMENTS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 9, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1. Fabricate casings with more than 3-inch wg negative static pressure according to SMACNA's "Rectangular Industrial Duct Construction Standards."
2. Casings with more than 2-inch wg positive static pressure may be fabricated according to SMACNA's "Rectangular Industrial Duct Construction Standards."

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Exterior Surface Galvanized Coating Designation: G60 (Z180).
2. Interior Surface Galvanized Coating Designation:

a. Sections Not Exposed to Moisture: G60 (Z180).
b. Sections Housing and Downstream from Cooling Coil and Humidifiers: G90 (Z275].

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

D. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections, and abutments to building.

E. Penetrations: Seal all penetrations airtight. Cover with escutcheons and gaskets, or fill with suitable compound so there is no exposed insulation. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping." Provide shaft seals where fan shafts penetrate casing.

F. Access Doors: Fabricate access doors according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 9-15, "Casing Access Doors - 2-inch wg," and Figure 9-16, "Casing Access Doors - 3-10-inch wg; and according to

pressure class of the plenum or casing section in which access doors are to be installed.

1. Size: 20 by 54 inches.
2. Vision Panel: Double-glazed, wire-reinforced safety glass with an airspace between panes and sealed with interior and exterior rubber seals.
3. Hinges: Piano or butt hinges and latches, number and size according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Latches: Minimum of two wedge-lever-type latches, operable from inside and outside.
5. Neoprene gaskets around entire perimeters of door frames.
6. Doors shall open against air pressure.

G. Condensate Drain Pans: Formed sections of G90 (Z275) coated, galvanized sheet steel complying with requirements in ASHRAE 62.1. Pans shall extend a minimum of 12 inches past coil.

1. Double-wall construction shall have space between walls filled with foam insulation and sealed moisture tight.
2. Intermediate drain pan or drain trough shall collect condensate from top coil for units with stacked coils or stacked eliminators.
3. Insulation: Polystyrene or polyurethane.
4. Slopes shall be in a minimum of two planes to collect condensate from cooling coils (including coil piping connections and return bends), eliminators, and humidifiers when units are operating at maximum catalogued face velocity across cooling coil.
5. Each drain pan connection shall have a trap. slab height in trap calculation.

2.2 MANUFACTURED CASINGS

A. Description: Double-wall, insulated, pressurized equipment casing.

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. Acoustical Surfaces, Inc.
2. AeroSonics, Inc.; a division of TUTCO, Inc.
3. Buffalo Air Handling.
4. CertainTeed Corp.; Insulation Group.
5. CLEANPAK International.
6. D&D Sound Control.
7. IACL.
8. Industrial Noise Control, Inc.
9. McGill AirSilence LLC.
10. SEMCO Incorporated.
11. Vibro-Acoustics.

C. Double-Wall Panel Fabrication: Solid, galvanized sheet steel exterior wall and [solid] [perforated], galvanized sheet steel interior wall; with space between wall filled with insulation.

1. Wall Thickness: 2 inches.
2. Fabricate with a minimum number of joints.
3. Weld exterior and interior walls to perimeter; to interior, longitudinal, galvanized-steel channels; and to box-end internal closures. Paint welds.
4. Sheet metal thickness shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for static-pressure class indicated for casing.
5. Sheet Metal Thicknesses:

    a. Exterior Wall Thickness: 0.040 inch minimum.
    b. Interior Wall Thickness: 0.034 inch minimum.

6. Double-Wall Casing Inner Panel: Perforated, galvanized sheet steel having 3/32-inch diameter perforations, with overall open area of 23 percent.
7. Double-Wall Casing Inner Panel: Solid sheet steel.
8. Fill each panel assembly with insulating material that is noncombustible, inert, mildew resistant, and vermin proof and that complies with NFPA 90A.
9. Fabricate panels with continuous self-locking joints effective inside and outside each panel.

D. Trim Items: Fabricate from a minimum of 0.052-inch galvanized sheet steel, furnished in standard lengths for field cutting.

2.3 CASING LINER

A. Fibrous-Glass Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

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. CertainTeed Corp.; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.

2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Flexible-Elastomeric Casing Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1, and with NFPA 90A or NFPA 90B.

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. Aeroflex USA Inc.
    b. Armacell LLC.
    c. Rubatex International, LLC.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Natural-Fiber Casing Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor, and complying with NFPA 90A or NFPA 90B.

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. Bonded Logic, Inc.
    b. Reflectix Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F mean temperature when tested according to ASTM C 518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank,

length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized steel, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

E. Shop or Factory Application of Casing Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of casing liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of casing liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of casings or cut and fit to ensure butted-edge overlapping.
5. Apply adhesive coating on longitudinal seams in casings with air velocity of 2500 fpm.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from casing wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined casing preceding unlined duct.
    c. Upstream edges of transverse joints in casings where air velocities are higher than 2500 fpm or where indicated.

8. Secure insulation between perforated sheet metal inner wall of same thickness as specified for outer wall. Use mechanical fasteners that maintain inner wall at uniform distance from outer wall without compressing insulation.

2.4 SEALANT MATERIALS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

8. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single component, acid curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install casings according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Equipment Mounting: Casing criteria shall be applied to factory build equipment which shall include split system air handlers suspended in the ceiling space and packaged rooftop units mounted on factory recommended curves.
1. Suspension support of Air Handling Units and the mounting of rooftop package units shall be in installed in compliance to factory equipment recommendations.

C. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
1. For supported casings, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Install seismic restraints on casings. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Apply sealant to joints, connections, and mountings.

F. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Support casings on floor or foundation system. Secure and seal to base.

H. Support components rigidly with ties, braces, brackets, seismic restraints, and anchors of types that will maintain housing shape and prevent buckling.

I. Align casings accurately at connections, with 1/8-inch misalignment tolerance and with smooth interior surfaces.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."
2. Test the following systems:

    a. Systems required by ASHRAE/IESNA 90.1.
    b. Supply Air: 100 percent of total installed duct area with a pressure class of 3-inch wg (750 Pa or higher.

3. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
4. Determine leakage from entire system or section of system by relating leakage to surface area of test section. Comply with requirements for leakage classification of ducts connected to casings.
5. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

B. HVAC casings will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 CLEANING

A. Comply with requirements for cleaning in Section 233113 "Metal Ducts."

END OF SECTION 233119

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. Related Requirements:
1. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. 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.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: [G60 (Z180)] [G90 (Z275)].
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and <Insert finish designation> finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.

3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Lloyd Industries, Inc.
6. Nailor Industries Inc.
7. NCA Manufacturing, Inc.
8. Pottorff.
9. Ruskin Company.
10. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: -inch wg .

E. Frame: Hat-shaped, 0.05-inch thick, galvanized sheet, with welded corners or mechanically attached[and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, 0.025-inch thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Vinyl, mechanically locked

I. Blade Axles:

1. Material:Stainless steel.
2. Diameter: 0.20 inch

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings:Steel ball.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. American Warming and Ventilating; a division of Mestek, Inc.
    c. Flexmaster U.S.A., Inc.
    d. McGill AirFlow LLC.
    e. Nailor Industries Inc.
    f. Pottorff.
    g. Ruskin Company.
    h. Trox USA Inc.
    i. Vent Products Company, Inc.

3. Standard leakage rating**[,** with linkage outside airstream.
4. Suitable for horizontal or vertical applications.
5. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel .
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Stainless-steel, 0.064 inch thick.

7. Blade Axles: Stainless steel.
8. Bearings:

    a. Oil-impregnated bronze[.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. McGill AirFlow LLC.
d. Nailor Industries Inc.
e. Pottorff.
f. Ruskin Company.
g. Trox USA Inc.
h. Vent Products Company, Inc.

3. Standard leakage rating, with linkage outside airstream.
4. Suitable for horizontal or vertical applications.
5. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.

7. Blade Axles Stainless steel **.**
8. Bearings:

   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Product indicated on Drawings or comparable product by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Lloyd Industries, Inc.
6. McGill AirFlow LLC.
7. Metal Form Manufacturing, Inc.
8. Nailor Industries Inc.
9. NCA Manufacturing, Inc.
10. Pottorff.
11. Ruskin Company.
12. Vent Products Company, Inc.
13. Young Regulator Company.

B. Frames:

1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel 0.05-inch-thick stainless steel.
3. Interlocking, gusseted corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. [ParalleL-blade design.
3. Stainless steel.
4. 0.064 inch (1.62 mm) thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel ; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Molded synthetic Oil-impregnated stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings product name or designation or comparable product by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff.
8. Prefco; Perfect Air Control, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Type: Static; rated and labeled according to UL 555 by an NRTL.

D. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

E. Fire Rating: 1-1/2 hours.

F. Frame: Curtain type with blades inside airstream Multiple-blade type Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream]; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

G. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 in thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

H. Mounting Orientation: Vertical or horizontal as indicated.

I. Blades: Roll-formed, interlocking, 0.024-inch thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

J. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

K. Heat-Responsive Device: Replaceable,165 deg F rated, fusible links.

L. Heat-Responsive Device: Electric, resettable link and switch package, factory installed, 165 deg F and 212 deg F rated.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings product name or designation> or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

D. Material: Galvanized steel.

E. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings; product name or designation or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings product name or designation or comparable product by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "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.
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: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches : Three hinges and two compression latches with outside and inside handles.
    d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.
4. .

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. FastenersStainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, 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 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.12 FLEXIBLE DUCTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1 .

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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 and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream[and downstream] from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. 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.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream[and downstream] from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches .

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts[directly or] with maximum 12-inch of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts[directly or] with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 23 34 16

CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: For each product.

1. Backward-inclined centrifugal fans.
2. Forward-curved centrifugal fans.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment 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.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance: Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

B. Capacities and Characteristics:

1. Total Airflow: Indicated on drawings.
2. External Static Pressure: Indicated on drawings
3. Class: I.
4. Housing Material: Stainless steel.
5. Special Housing Coating: Thermoplastic vinyl Color-match ename];
6. Wheel Size (Diameter): Indicated on drawings.
7. Wheel Material: Stainless steel.
8. Special Wheel Coating: Thermoplastic vinyl .
9. Brake Horsepower: Indicated on drawings .
10. Drive Type: Belt .
11. Fan Rpm: Indicated on drawings .
12. Outlet Velocity: Indicated on drawings.
13. Motor: Indicated on drawings

    a. Electrical Characteristics:

        1) Motor Size: Indicated on drawings.
        2) Motor Rpm: Indicated on drawings.
        3) Volts: Indicated on drawings .
        4) Phase: Single.
        5) Hertz: 60.
        6) Full-Load Amperes: Indicated on drawings.
        7) Minimum Circuit Ampacity: Indicated on drawings.
        8) Maximum Overcurrent Protection: Indicated on drawings.

14. Vibration Isolators: Spring isolators having a static deflection of 1 inch (25 .
15. Spark-Resistance Class: A.

2.2 BACKWARD-INCLINED CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan company.
3. Central Blower Company.
4. Chicago Blower Corporation.
5. Cincinnati Fan.
6. CML Northern Blower Inc.
7. Howden Buffalo Inc.
8. Loren Cook Company.
9. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Backward-Inclined Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 FORWARD-CURVED CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Central Blower Company.
3. Howden Buffalo Inc.
4. Lau Industries.

5. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Forward-Curved Wheels:

1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting: Install centrifugal fans on cast-in-place concrete equipment base(s) using elastomeric pads (Exhaust fan-Roof mounted). Comply with requirements for equipment bases specified in Section 033000 "Cast-in-Place

Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."]Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1/4 inch.

E. Equipment Mounting: Install centrifugal fans using elastomeric pads . Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1/4 inch

F. Equipment Mounting: Install centrifugal fans on vibration isolation equipment base. Comply with requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

G. Equipment Mounting: Install centrifugal fans with <Insert seismic-restraint device>. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

H. Equipment Mounting: Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support weight of dehumidification unit.

1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

I. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction.[Secure units to curb support with anchor bolts.]

J. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

K. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration isolation and seismic-control devices.

1. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
2. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation and seismic-control devices.

L. Install units with clearances for service and maintenance.

M. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rectangular and square ceiling diffusers.
2. Louver face diffusers.
3. Adjustable bar registers and grilles.
4. Fixed face registers and grilles.

B. Related Sections:

1. Section 089000 "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers :
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Hart & Cooley Inc.
e. Krueger.

f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel
4. Finish: Baked enamel, white
5. Face Size: 24 by 24 inches , 12 by 12 inches
6. Face Style: Three cone, Refer to mechanical Diffuser schedule
7. Mounting: Surface
8. Pattern: Fixed
9. Dampers: Radial opposed blade, Butterfly
10. Accessories:

a. Equalizing grid.
b. Plaster ring.
c. Safety chain.
d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.

B. Louver Face Diffuser :
1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. METALAIRE, Inc.
e. Nailor Industries Inc.
f. Price Industries.
g. Titus.
h. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white .
5. Face Size: Insert inches .
6. Mounting: Surface.
7. Pattern: One-way core style.
8. Dampers: Radial opposed blade.
9. Accessories:

a. Square to round neck adaptor.
b. Adjustable pattern vanes.
c. Throw reducing vanes.
d. Equalizing grid.
e. Plaster ring.
f. Safety chain.
g. Wire guard.
h. Sectorizing baffles.

i. Operating rod extension.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register :
1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Dayus Register & Grille Inc.
e. Hart & Cooley Inc.
f. Krueger.
g. METALAIRE, Inc.
h. Nailor Industries Inc.
i. Price Industries.
j. Titus.
k. Tuttle & Bailey.

2. Material: Stainless steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3 inches (76 mm) apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch (19 mm apart.
7. Frame: 1-1/4 inches (32 mm) wide.
8. Mounting Frame: Filter.
9. Mounting: Countersunk screw.

a. Front-blade gang operator.

B. Fixed Face Register:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Dayus Register & Grille Inc.
e. Hart & Cooley Inc.
f. Krueger.
g. Nailor Industries Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

3. Material: Stainless steel.
4. Finish: Baked enamel, white.

5. Face Blade Arrangement: Horizontal spaced 3 inches apart.
6. Core Construction: Integral.
7. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
8. Frame: 1-1/4 inches wide.
9. Mounting Frame: Filter.
10. Mounting: Countersunk screw.
11. Core Construction: Integral,Removable
12. Frame: 1-1/4 inches wide.
13. Mounting Frame: Filter
14. Mounting: Countersunk screw, Concealed, Lay in.
15. Damper Type: Adjustable opposed blade.
16. Accessory: Filter.

C. Fixed Face Grille:

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]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawing] or comparable product by one of the following:

    a. A-J Manufacturing Co., Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Dayus Register & Grille Inc.
    e. Hart & Cooley Inc.
    f. Krueger.
    g. Nailor Industries Inc.
    h. Price Industries.
    i. Titus.
    j. Tuttle & Bailey.
    .

3. Material: Steel
4. Finish: Baked enamel, white.
5. Face Arrangement: 1/2-by-1/2-by-1/2-inch Perforated Core
6. Construction: Integral or Removable.
7. Frame: 1-1/4 inches
8. Mounting Frame: Filter.
9. Mounting: Countersunk screw .
10. Accessory: Filter.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 74 13

PACKAGED OUTDOOR CENTRAL AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Hot-gas reheat.
3. Electric-heating coils.
4. Gas furnace.
5. Economizer outdoor- and return-air damper section.
6. Integral, space temperature controls.
7. Roof curbs.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design RTU supports to comply with **wind and seismic** performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind and Seismic-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans 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. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

1.9 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.

2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. 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.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. AAON, Inc.
2. Addison Products Company.
3. Carrier Corporation.
4. Engineered Air.
5. Lennox Industries Inc.
6. McQuay International.
7. Trane; American Standard Companies, Inc.
8. YORK International Corporation.

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: minimum 0.0626 inch (1.6 mm) thick.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Refer to manufacturer’s specifications.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch (25 mm).
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep and complying with ASHRAE 62.1.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple both sides of drain pan.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Refer to manufacturer’s specifications.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

D. Relief-Air Fan: Refer to manufacturer’s specifications.

E. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

F. Fan Motor: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Refer to manufacture's specifications for fin and coil tube type
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Provide tube coating per manufacture's specifications: Baked phenolic or Cathodic epoxy.
5. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum or Copper-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor. Refer to manufacturer's specifications.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Baked phenolic or Cathodic epoxy coating. Refer to manufacturer's specifications.

2.5 GAS HEATING

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
3. High-Altitude model: For Project elevations more than 2000 feet (610 m) above sea level.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Refer to manufacture's specifications.

Safety Controls:

1. Gas Control Valve: Refer to manufacture's specifications.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff

2.6 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Refer to manufactures' specifications.

B. Compressor: Refer to manufactures' specifications.

C. Refrigeration Specialties:

1. Refrigerant: R-410A
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.7 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Glass Fiber: Minimum[80 percent arrestance, and MERV-13
2. Pleated: Minimum 90 percent arrestance, and MERV 13.

2.8 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.

B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC."

B. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

a. Heat-cool-off switch.
b. Fan on-auto switch.
c. Fan-speed switch.
Automatic changeover.
d. Adjustable deadband.
e. Concealed set point.
f. Concealed indication.
Degree F indication.
g. Unoccupied-period-override push button.
h. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.

3. Remote Wall Unit-Mounted Annunciator Panel for Each Unit:

a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

C. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature[and humidity.
d. Monitoring occupied and unoccupied operations.
e. Monitoring constant and variable motor loads.
f. Monitoring variable-frequency drive operation.
g. Monitoring cooling load.
h. Monitoring economizer cycles.
i. Monitoring air-distribution static pressure and ventilation air volume.

2.11 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Low-ambient kit using staged damper on variable-speed condenser fans for operation down to 35 deg F (1.7 deg C)

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Coil guards of painted, galvanized-steel wire.

E. Hail guards of galvanized steel, painted to match casing.

F. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

   a. Materials: ASTM C 1071, Type I or II.
   b. Thickness: Refer to manufacture’s specifications.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

   a. Liner Adhesive: Comply with ASTM C 916, Type I.
   b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
   c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
   d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 14 inches

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for wind-load requirements.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

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

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." [ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Unit Support: Install unit level on structural **curbs** Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

C. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

5. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified with concrete.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.

17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.

d. Economizer to minimum outdoor-air changeover.
e. Relief-air fan operation.
f. Smoke and firestat alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 23 81 26

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. 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."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

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: Five years from date of Substantial Completion.
c. For Labor: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawing or comparable product by one of the following:

1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
2. Coleman Company Inc. (The).
3. First Operations LP.
4. Friedrich Air Conditioning Company.
5. Koldwave, Inc.; a Mestek company.
6. Lennox International Inc.
7. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
8. Mitsubishi Electric Sales Canada Inc.
9. Mitsubishi Heavy Industries America, Inc.
10. SANYO North America Corporation; SANYO Fisher Company.
11. Trane; a business of American Standard companies.
12. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

7. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
9. Filters: Permanent, cleanable.
10. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches (50 mm) deep.

    b. Single-wall,stainless-steel sheet.
    c. Double-wall,stainlesssteel sheet with space between walls filled with foam insulation and moisture-tight seal.
    d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

        1) Minimum Connection Size: NPS 1 (DN 25) .

    e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
    f. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

B. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.

    a. Discharge Grille: Steel with surface-mounted frame.
    b. Insulation: Faced, glass-fiber duct liner.
    c. Drain Pans: Galvanized steel, with connection for drain; insulated.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; with a two-position control valve.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in

magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

5. Fan: Direct drive, centrifugal, with power-induced outside air.
6. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.

7. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

        1) Comply with NFPA 90A.
        2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

    b. Disposable Panel Filters:

        1) Factory-fabricated, viscous-coated, flat-panel type.
        2) Thickness: 2 inches (50 mm.
        3) Arrestance according to ASHRAE 52.1: 80 .
        4) Merv according to ASHRAE 52.2: 5.
        5) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
        6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

    c. Extended-Surface, Disposable Panel Filters:

        1) Factory-fabricated, dry, extended-surface type.
        2) Thickness: 2 inches (50 mm).
        3) Arrestance according to ASHRAE 52.1: 90 .
        4) Merv according to ASHRAE 52.2: 7.
        5) Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.
        6) Media-Grid Frame: Galvanized steel[.
        7) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

C. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in

magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.

4. Fan: Direct drive, centrifugal.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    f. Mount unit-mounted disconnect switches on [**exterior**] [**interior**] of unit.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 1 inch 25 mm deep.

    b. Single-wall, stainless-steel sheet.
    c. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
    d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

        1) Minimum Connection Size: [PS 1 (DN 25.

    e. Pan-Top Surface Coating: Asphaltic waterproofing compound.

8. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

        1) Comply with NFPA 90A.
        2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

    b. Disposable Panel Filters:

        1) Factory-fabricated, viscous-coated, flat-panel type.

2) Thickness: 1 inch (25 mm) .
3) Merv according to ASHRAE 52.2: 5 .
4) Media: Interlaced glass fibers sprayed with nonflammable adhesive[and antimicrobial agent.
5) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

c. Extended-Surface, Disposable Panel Filters:

1) Factory-fabricated, dry, extended-surface type.
2) Thickness:1 inch (25 mm).
3) Merv according to ASHRAE 52.2: 7 .
4) Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.
5) Media-Grid Frame: Galvanized steel.
6) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.
b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
c. Refrigerant Charge: R-410A.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

F. Drain Hose: For condensate.

G. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

2.5 CAPACITIES AND CHARACTERISTICS

A. Refer to Schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base that is 4 inches (100 mm) larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

E. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

F. Install seismic restraints.

G. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm. See Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

H. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for pathways and cables.
2. Sleeve seals.
3. Grout.
4. Common communications installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

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 water-stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches (400 mm), thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings comparable product by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
4. Pressure Plates: Stainless steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS 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-mounting 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 communications 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 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 6 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

3.3 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "FIRE STOPPING."

END OF SECTION 26 05 00

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

E. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC, metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

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.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway. Underground feeder cable, Type UF may be used for site lighting.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm of slack.

3.5 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 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 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 07 84 00 " FIRESTOPPING."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

a. Emergency System Feeders.

b. MEMA System Feeders.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. 50/125-micrometer, multimode optical fiber cabling.
3. RS-232 cabling.
4. RS-485 cabling.
5. Low-voltage control cabling.
6. Control-circuit conductors.
7. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

H. RCDD: Registered Communications Distribution Designer.

I. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

J. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

K. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wire and cable to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

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

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

a. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
b. Trough or Ventilated Cable Trays: Nominally 6 inches (150 mm) wide.
c. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).

d. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
e. Solid-Bottom or Nonventilated Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.

C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 UTP CABLE

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

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, four-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or Type CMG; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, or Type MPG.
b. Communications, Plenum Rated: Type CMP or Type MPP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR; or Type MPP, Type CMP, or Type MPR; complying with UL 1666.
d. Communications, Limited Purpose: Type CMX; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, Type MPG, Type CM, or Type CMG.

e. Multipurpose: Type MP or Type MPG; or Type MPP or Type MPR.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR or Type MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

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

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

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

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: Multimode, 62.5/125-micrometer, 24 number-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-A for detailed specifications.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. General Purpose, Nonconductive: Type OFN or OFNG, or Type OFNR or Type OFNP.
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR or Type OFNP, complying with UL 1666.
    d. General Purpose, Conductive: Type OFC or Type OFCG; or Type OFNG, Type OFN, Type OFCR, Type OFNR, Type OFCP, or Type OFNP.
    e. Plenum Rated, Conductive: Type OFCP or Type OFNP, complying with NFPA 262.
    f. Riser Rated, Conductive: Type OFCR; or Type OFNR, Type OFCP, or Type OFNP; complying with UL 1666.

5. Conductive cable shall be steel-armored type.
6. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

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

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC or Type ST connectors. Insertion loss not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or Type CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.9 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.10 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or Type XHHN, in raceway or power-limited tray cable, in cable tray, complying with UL 83 & UL 44 where applicable.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.11 IDENTIFICATION PRODUCTS

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

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows if possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Section 07 84 00 "FIRESTOPPING."

B. Comply with TIA/EIA-569-A, Annex A, "FIRESTOPPING."

C. Comply with BICSI TDMM, "FIRESTOPPING Systems" Article.

3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
        2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Overhead-line grounding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding for sensitive electronic equipment.

B. Qualification Data: For qualified testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS & NFPA 70B.

    a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA and/or NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-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 (6 mm) 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 (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 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.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad

B. Steel 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

C. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

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. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Connections to Ground Rods at Test Wells: Bolted connectors.

3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install two parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches (300 mm) below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. 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.

D. Water Heater, Heat-Tracing, and Antifrost Heating 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.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. 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, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.4 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. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. 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.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. 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.

3.5 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. 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.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 7200 "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. 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. 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.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4 requirements.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

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. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles**,** except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. 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.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. 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.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. 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 055000 "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, IMC, and RMC as required by NEC.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. 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 (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
7. To Light Steel: Sheet metal screws.
8. 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 by means that meet seismic-restraint strength and anchorage requirements.

E. 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 5000 "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 (0.05 mm).

B. Touchup: Comply with requirements in Section 09 91 00 “PAINTING” for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 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.

C. Samples: For wireways, nonmetallic wireways and surface raceways and for each color and texture specified, 12 inches (300 mm) long.

1.5 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. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. 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; a Tyco International Ltd. Co.
3. Electri-Flex Company.
4. O-Z/Gedney; a brand of EGS Electrical Group.
5. Robroy Industries.
6. Southwire Company.
7. Thomas & Betts Corporation.
8. Western Tube and Conduit Corporation.

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. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit or IMC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel or aluminum.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel or die cast.
   b. Type: Setscrew or compression.

3. 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.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. 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 CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic 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. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R or Type 4 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. Wireway Covers: Hinged type or Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

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

1. Allied Moulded Products, Inc.
2. Hoffman; a Pentair company.
3. Lamson & Sessions; Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 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. **In general, all conduit raceways run inside the building shall be concealed in walls or above ceilings.**

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

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman; a Pentair company.
5. Hubbell Incorporated; Killark Division.
6. Milbank Manufacturing Co.
7. O-Z/Gedney; a brand of EGS Electrical Group.
8. RACO; a Hubbell Company.
9. Spring City Electrical Manufacturing Company.
10. Thomas & Betts Corporation.

C. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1 aluminum, Type FD, with gasketed cover.

F. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

G. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Semi-adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

M. Gangable boxes are prohibited.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R or Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic is not acceptable.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1, Type 3R or Type 4 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.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground RNC, Type EPC-40-PVC or EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried or concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT, ENT or RNC.
2. Exposed, Not Subject to Severe Physical Damage: EMT or RNC identified for such use.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

    a. Mechanical rooms.
    b. MDF / IDF Rooms
    c. Storage Rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: ENT.
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: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C)

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. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) 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 260529 "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 (300 mm) 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 (300 mm)of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m)intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to RNC, Type EPC-40-PVC, GRC or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. 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.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. 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 (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. 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.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm)radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. 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.

U. 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 an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. 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 and EMT 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 (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) 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.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) 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 or LFNC in damp or wet locations not subject to severe physical damage.

Y. 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 bottom of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. 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.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. 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 260544 "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 07 84 00 "FIRESTOPPING."

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

SECTION 26 05 39

UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Flat-top, Single-Channel, Underfloor Raceways

A. Number of Levels: One.

B. Service Raceways:

1. Nominal Raceway Dimensions:

a. Depth: 1-1/2 inches (38 mm).
b. Power Service Raceway Width: 3-1/2 inches (90 mm).
c. Communication Service Raceway Width: 3-1/2 inches (90 mm).

2. Number of Single-Channel Raceways per Run: One.
3. Preset Inserts: Round, spaced 24 inches (600 mm) o.c.

C. Header Raceways:

1. Nominal Raceway Dimensions:

a. Depth: 1-1/2 inches (38 mm).
b. Power Header Raceway Width: 3-1/2 inches (90 mm).
c. Communication Header Raceway Width: 3-1/2 inches (90 mm).

2. Arrangement: In same plane as Below service raceways.
3. Connections: Arranged to connect with service raceways at single-level junction boxes.

1.2 Trench-Type Underfloor Raceways

A. Multipartition, with partitions arranged to separate channels and isolate wiring of different systems.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 84 00 "FIRESTOPPING" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content in according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 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 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. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, 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.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 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 raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, 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.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, 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. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

D. Tag: Type II:

1. Multilayer laminate consisting of high-density polyethylene scrim coated with pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 12 mils (0.3 mm).
3. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 400 lbf (1780 N), and 11,500 psi (79.2 MPa).

E. Tag: Type ID

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

F. Tag: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
5. 3-Inch (75-mm)Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. 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 (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. 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 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. 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 (10 mm).

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be **1 inch (25 mm)**.

2.10 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 (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
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 (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.11 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. 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

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. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot (3-m) maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label labels at 10-foot (3-m) maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

E. 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 service 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 (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. 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.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. 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.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

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. Power transfer switches.
    b. Controls with external control power connections.

M. 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.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

O. 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- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) 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. Motor-control centers.
    e. Enclosed switches.
    f. Enclosed circuit breakers.
    g. Enclosed controllers.
    h. Variable-speed controllers.
    i. Push-button stations.
    j. Contactors.
    k. Remote-controlled switches, dimmer modules, and control devices.
    l. Monitoring and control equipment.

END OF SECTION

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1. Coordination of series-rated devices is permitted where indicated on Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For coordination-study specialist.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.

h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
1. VFD-controlers.
2. Distribution panelboard.
3. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141 and IEEE 242.

1. Transformers:

a. ANSI C57.12.10.
b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.
3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
2. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors

at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with **IEEE 141, IEEE 241 and IEEE 242** recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

    a. Device tag.
    b. Voltage and current ratio for curves.
    c. Three-phase and single-phase damage points for each transformer.
    d. No damage, melting, and clearing curves for fuses.
    e. Cable damage curves.
    f. Transformer inrush points.
    g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.

B. Related Requirements:

1. Section 26 2726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 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 TIME SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Invensys Controls.
4. Leviton Mfg. Company Inc.
5. NSi Industries LLC; TORK Products.
6. Tyco Electronics; ALR Brand.

C. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: DPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Eight on-off set points on a 24-hour schedule[and an annual holiday schedule that overrides the weekly operation on holidays].
5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
6. Programs: channels; each channel is individually programmable with eight on-off set points on a 24-hour schedule.
7. Programs: channels; each channel is individually programmable with two on-off set points on a 24-hour schedule with a skip-a-day weekly schedule.
8. Programs: channels; each channel is individually programmable with two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.
9. Programs: channels; each channel is individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
10. Programs: channels; each channel is individually programmable with 40 on-off operations per week, plus four seasonal schedules that modify the basic program, and an annual holiday schedule that overrides the weekly operation on holidays.
11. Programs: and an annual holiday schedule that overrides the weekly operation on holidays.
12. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
13. Astronomic Time: All channels.
14. Automatic daylight savings time changeover.
15. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

D. Electromechanical-Dial Time Switches: Comply with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Contact Configuration: DPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Astronomic time dial.
6. Eight-Day Program: Uniquely programmable for each weekday and holidays.
7. Skip-a-day mode.
8. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Tyco Electronics; ALR Brand.

C. Description: Solid state, with DPST 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. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

D. Description: Solid state, with DPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.
5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements [provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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. Square D; a brand of Schneider Electric.
9. Watt Stopper.

C. General Requirements for Sensors: Wall- or 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-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 (13-mm) 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 (21.5 to 2152 lux); turn lights off when selected lighting level is present.

D. 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- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/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- (2440-mm-) high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.
12. Watt Stopper.

C. 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, and shall comply with California Title 24.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V and 800-W incandescent.

D. Wall-Switch Sensor Tag M:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage type.
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. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

E. Wall-Switch Sensor Tag WS2:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage type.
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. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.5 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with fusible switch**,** complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as required by manufacturer or indicated on Drawings, matching the NEMA type specified for the enclosure.

2.6 EMERGENCY SHUNT RELAY

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Lighting Control and Design; Acuity Lighting Group, Inc.
2. Watt Stopper.

C. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120V.

2.7 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 260519 "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 260519 "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 260519 "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 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

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.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "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.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 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.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 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. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. 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.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.7 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 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.8 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: Two 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.
3. 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.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.10 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.

1.11 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 (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. 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 Architect and owner no fewer than two weeks in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's or Construction Manager's written permission.
3. Comply with NFPA 70E.

1.12 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: 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 stee.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted inmetal frame with transparent protective cover.

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. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
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. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product 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.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

E. Mains: Circuit breaker or Lugs only as indicated on the drawings.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

I. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 24-V control circuit.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only as indicated on the drawings.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 24-V control circuit.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 ELECTRONIC-GRADE PANELBOARDS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

E. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

F. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

G. Buses:

1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
2. Copper equipment and isolated ground buses.

H. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in or bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition, and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.

1. Accessories:

a. Fuses rated at 200-kA interrupting capacity.
b. Fabrication using bolted compression lugs for internal wiring.
c. Integral disconnect switch.
d. Redundant suppression circuits.
e. Redundant replaceable modules.
f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
g. LED indicator lights for power and protection status.
h. Audible alarm, with silencing switch, to indicate when protection has failed.
i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
j. Four-digit, transient-event counter set to totalize transient surges.

2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

a. Line to Neutral: 70,000A.
b. Line to Ground: 70,000A.
c. Neutral to Ground: 50,000A.

4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

5. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:

a. Line to Neutral: 400 V, 800 V from high leg.
b. Line to Ground: 400 V.
c. Neutral to Ground: 400 V.

6. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

a. Line to Line: 2000 V for 480 V.
b. Line to Ground: 1500 V for 480 V.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. 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.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
    f. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 PANELBOARD SUPPRESSORS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

a. LED indicator lights for power and protection status.
b. Audible alarm, with silencing switch, to indicate when protection has failed.
c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

D. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in or bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

   a. Fuses rated at 200-kA interrupting capacity.
   b. Fabrication using bolted compression lugs for internal wiring.
   c. Integral disconnect switch.
   d. Redundant suppression circuits.
   e. Redundant replaceable modules.
   f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   g. LED indicator lights for power and protection status.
   h. Audible alarm, with silencing switch, to indicate when protection has failed.
   i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
   j. Four-digit, transient-event counter set to totalize transient surges.

2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

   a. Line to Neutral: 70,000A.
   b. Line to Ground: 70,000A.
   c. Neutral to Ground: 50,000A.

4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

5. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:

   a. Line to Neutral: 400 V.
   b. Line to Ground: 400 V.
   c. Neutral to Ground: 400 V.

6. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:

   a. Line to Neutral: 400 V, 800 V from high leg.
   b. Line to Ground: 400 V.
   c. Neutral to Ground: 400 V.

7. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

   a. Line to Line: 2000 V for 480 V.
   b. Line to Ground: 1500 V for 480 V.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to **NECA 407**.

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 NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. 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.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. 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 or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. 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. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Receptacles with integral surge-suppression units.
3. Isolated-ground receptacles.
4. Weather-resistant receptacles.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.
7. Floor service outlets and multioutlet assemblies.

1.3 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.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 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.

1.8 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. Floor Service-Outlet Assemblies: Where shown on the plans.
2. Poke-Through, Fire-Rated Closure Plugs: Where shown on the plans.
3. TVSS Receptacles: Where shown on the plans.

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.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

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 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. Isolated-Ground, Duplex 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 the following:

a. Cooper; IG5362RN.
b. Hubbell; IG5362.
c. Leviton; 5362-IG.
d. Pass & Seymour; IG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, 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 the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.

d. Leviton; 7590.

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide the following:

a. Cooper; 5362BLS.
b. Hubbell; HBL5362SA.
c. Leviton; 5380.
d. Pass & Seymour; 5362BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide the following:

a. Cooper; IG5362BLS.
b. Hubbell; IG5362SA.
c. Leviton; 5380-IG.
d. Pass & Seymour; IG5362BLSP.

2. Description:

a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 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: 0.04-inch- (1-mm-) thick steel with chrome-plated finish.
3. Material for Unfinished Spaces: Galvanized steel
4. 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.
1. Horizontal Cabling."

2.8 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

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 (152 mm) 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 up down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. 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.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. 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 262726

SECTION 26 28 13

FUSES

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

1.3 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. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 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.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C) apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 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 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 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- (38-mm-) 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 RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC, fast acting.

B. Plug Fuses:

1. Motor Branch Circuits: Edison-base type, dual-element time delay.
2. Other Branch Circuits: Edison-base type, single-element fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "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

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 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. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. 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.

D. Manufacturer's field service report.

1.7 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 7823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. 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.

1.8 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.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.10 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 (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 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 Construction Manager no fewer than seven 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.

1.11 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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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.

C. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge or plug fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

G. 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. 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: One or Two 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; 24-V ac, 120-V ac or 208-V ac.

2.2 NONFUSIBLE SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Single Throw, 240-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.

E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 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.

F. Type HD, Heavy Duty, Double Throw, 240-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.

G. 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. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One or Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac, 120-V ac or 208-V ac.

2.3 RECEPTACLE SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240-V ac, 30A; 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; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240-V ac, 30A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

2.4 MOLDED-CASE CIRCUIT BREAKERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. 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.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

K. 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; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Section 260913 "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO] contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Integrally mounted, self-powered; 24-V ac or 120-V .

2.5 MOLDED-CASE SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 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.

C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NO contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered; 24-V ac or 120-V ac.

2.6 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 3R
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

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. Comply with mounting and anchoring requirements specified in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 "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. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. 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.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. 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.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 43 13

PROTECTION DEVICE FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPD for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections:
1. Section 26 2416 "Panelboards" for factory-installed SPD.
2. Section 26 2726 "Wiring Devices" for devices with integral SPD.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. SPD: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Certificates: For SPD devices, from manufacturer.

C. Field quality-control reports.

D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For SPD devices to include in emergency, operation, and maintenance manuals.

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.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

D. Comply with NEMA LS 1.

E. Comply with UL 1283 and ANSI/UL 1449 3RD Edition.

F. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to 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 Construction Manager and Owner no fewer than two weeks in advance of proposed electrical service interruptions.
2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

B. Service Conditions: Rate SPD devices for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.10 COORDINATION

A. Coordinate location of field-mounted SPD devices to allow adequate clearances for maintenance.

B. Coordinate SPD devices with Section 26 0913 "Electrical Power Monitoring and Control."

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

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

B. Basis-of-Design Product: Surge Suppression Inc. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AC Data Solutions..
2. Atlantic Scientific.
3. Current Technology Inc.; Danaher Power Solutions.
4. Danaher Power Solutions; United Power Products..
5. Intermatic, Inc.
6. LEA International.
7. Leviton Mfg. Company Inc.
8. Liebert Corporation; a division of Emerson Network Power.
9. Northern Technologies, Inc.; a division of Emerson Network Power.
10. Surge Suppression Incorporated.

C. Surge Protection Devices:

1. Non-modular.
2. LED indicator lights for power and protection status.
3. Audible alarm, with silencing switch, to indicate when protection has failed.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
5. Type 1 SPD Nominal Discharge Current Rating: 20kA

D. Peak Single-Impulse Surge Current Rating: 100 kA per mode/300 kA per phase.

E. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000A.
2. Line to Ground: 70,000A.
3. Neutral to Ground: 50,000A.

F. , single-phase, 3-wire circuits shall be as follows:

1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

G. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

H. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V.
2. Line to Ground: 2000 V for 480 V.

2.2 PANELBOARD SUPPRESSORS

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

B. Basis-of-Design Product: Surge Suppression Inc. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AC Data Solutions..
2. Atlantic Scientific.
3. Current Technology Inc.; Danaher Power Solutions.
4. Danaher Power Solutions; United Power Products..
5. Intermatic, Inc.
6. LEA International.
7. Leviton Mfg. Company Inc.
8. Liebert Corporation; a division of Emerson Network Power.
9. Northern Technologies, Inc.; a division of Emerson Network Power.
10. Surge Suppression Incorporated.

C. Surge Protection Devices:

1. Non-modular.
2. LED indicator lights for power and protection status.
3. Audible alarm, with silencing switch, to indicate when protection has failed.

4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

D. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design (with field-replaceable modules).
3. Short-circuit current rating complying with UL 1449, and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors.
4. Fuses, rated at 200-kA interrupting capacity.
5. Fabrication using bolted compression lugs for internal wiring.
6. Integral disconnect switch.
7. Redundant suppression circuits.
8. Redundant replaceable modules.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.
11. Audible alarm, with silencing switch, to indicate when protection has failed.
12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
13. **Four digit transient-event counter set to totalize transient surges.**

E. Peak Single-Impulse Surge Current Rating:

1. **Distribution Panels 250 Amps or higher: 160kA per mode / 180 kA per phase.**
2. **Branch Panels up to 225 Amps: 40 kA per mode / 120 kA per phase**.

F. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:

1. Line to Neutral: 70,000A.
2. Line to Ground: 70,000A.
3. Neutral to Ground: 50,000A.

G. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 400 V for 208Y/120 V.
2. Line to Ground: 400 V for 208Y/120 V.
3. Neutral to Ground: 400 V for 208Y/120 V.

H. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:

1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

I. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

J. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

1. Line to Line: 1000 V for 240 V.
2. Line to Ground800 V for 240 V.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

B. Outdoor Enclosures: NEMA 250 Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, **30**-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated. Bus-Mounted SPD’s shall not be permitted.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup checks according to manufacturer's written instructions.

E. TVSS device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect service entrance equipment to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting fixture.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Action Submittals" Article in Section 233713 "Diffusers, Registers, and Grilles."

5. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."
6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. 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. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

1.5 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. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Structural members to which suspension systems for lighting fixtures will be attached.
5. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

6. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Led Fixtures: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every **20** of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program 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, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

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 NFPA 70.

E. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. 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 0.125inch (3.175 mm) minimum unless otherwise indicated.
    b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located 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. CCT and CRI for all luminaires.

G. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
1. Power Factor: 0.95[, except fixtures designated as "Residential" may use low-power-factor electronic ballasts or higher.
2. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

2.3 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): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Time-Delay Relay: Holds unit on for fixed interval of **15** minutes when power is restored after an outage.
7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "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 (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of REMOTE DRIVERS: Distance between the driver and fixture shall not exceed that recommended by fixture manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) 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 (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have the breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within **24** months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION

SECTION 26 51 13
INTERIOR LIGHTING LED DIMMING DRIVERS

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PART 1- GENERAL

SUMMARY

A. Section Includes:
   1. LED dimming driver.

B. Related Sections:
   1. Edit the following subparagraphs to coordinate with other sections in the Project Manual.
   2. Section 26 2726 - Wiring Devices
   3. Section 26 5100 – Interior Lighting
   4. Section 26 0923 – Lighting Control Devices:

REFERENCES

C. Underwriters Laboratories, Inc. (UL)
   1. 1310 and 8750 – Light Emitting Diode (LED) equipment for use in lighting products.

D. American National Standards Institute (ANSI)
   1. ANSI C82.11 – Performance requirement for high frequency ballasts
   2. ANSI/IES RP-16-10 – Nomenclature and definitions for illuminating engineering
   3. ANSIE1.20 - Remote Device Management Over DMX512 Networks
   4. ANSI C62.41 – Recommended practice in low power circuits

E. International Electrotechnical Commission (IEC).
   1. IEC 61347-1 – General and safety requirements for lamp control gear
   2. IEC 61347-2-13 – Particular requirements for electronic control gear for LED modules
   3. IEC 62384 b- DC or AC supplied electronic control gear for LED modules – performance requirements
   4. IEC 61000-3-2 - Harmonic current emissions
   5. IEC 61547 - EMC immunity requirements
   6. IEC 62386-101/102/207 – Digital addressable lighting interface (DALI)

F. European Mark for electrotechnical products (ENEC)
   1. EN55015 – Radio disturbances <30 Mhz
   2. EN55022– Performance requirement for EMC, Information technology and Telecommunications equip.
   3. EN60929/IEC60929 – Performance requirement for AC supplied electronic equipment

G. Federal Communications Commission (FCC) rules – Part 15 Class B: Radio Frequency Devices.
   1. Commercial rated

H. Entertainment Services and Technology Association
   1. ESTA E1.3 - Entertainment Technology - Lighting Control System - 0 to 10V Analog Control Protocol

I. Institute for Electrical and Electronics Engineers (IEEE)

1. IEEE PAR1789 - Recommending practices for modulating current in High Brightness LEDs for mitigating health risks to viewers

SUBMITTALS

J. See Section 013000 – Administrative Requirements for submittal procedures

K. Shop Drawings: Clearly indicate the name of the job, Architect/Engineer and list fixture type (s) for each specific driver. Contractor shall endeavor to submit all drivers as one package along with the luminaire package.

L. Product Data: Provide dimensions, ratings and specific catalog number and identification of items and accessories and performance data.

M. Wiring Diagrams – as needed for special operation or interaction with other system(s)

DESCRIPTION

N. LED dimming driver.
   1. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
   2. Digital (DALI Low Voltage Controlled) Dimming Drivers
   3. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers

QUALITY ASSURANCE

O. Manufacturer: Minimum 5 years experience in manufacture of dimmable electronic lighting drivers.

P. Recognized by UL for use in the US and Canada. Provide evidence of compliance upon request.

PROJECT CONDITIONS

Q. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: -20 degrees to 50 degrees C (-4 degrees to 122 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. Protected from dust and excess moisture during installation.

WARRANTY

R. Provide manufacturer’s warranty covering 5 years on drivers from date of purchase. Luminaire manufacture to operate driver at or below the required driver warranty temperature. Luminaire manufacturers failing to operate the driver, at the project required ambient temperature, within the driver manufacturer warranty parameters will be responsible for all driver warranty related costs over the warranty period.

- PRODUCTS

MANUFACTURERS

S. Acceptable Manufacturer: eldoLED

T. Basis of design product: eldoLED or subject to compliance and prior approval with specified requirements of this section, one of the following:
   1. EldoLED
   2. Douglas Lighting Control

GENERAL

U. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

V. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

W. Driver must limit inrush current.
   1. Base specification: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 $Amps^2$ – seconds.
   2. Preferred Specification: Meet or exceed 30mA^2s at 277VAC for up to 50 watts of load and 75A at 240us at 277VAC for 100 watts of load.

X. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

Y. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

Z. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

AA. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   1. Adjustment of forward LED voltage, supporting 3V through 55V.
   2. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA
   3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

BB. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.

CC. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

DD. Driver shall include ability to provide no light output when the analog control signal drops below 0.3 V , or the DALI/DMX digital signal calls for light to be extinguised and shall consume 0.5 watts or less in this standby. Control deadband between 0.3V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

LIGHT QUALITY

EE. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0% relative light output, or 100 – 1% light output and step to 0% where indicated. Driver shall respond similarly when raising from 0% to 100%

1. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.

FF. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels

GG. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

HH. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:
1. LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
2. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
3. Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz

CONTROL INPUT

II. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
1. Must meet IEC 60929 Annex E for General White Lighting LED drivers
2. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
3. Must meet ESTA E1.3 for RGBW LED drivers

JJ. Digital (DALI Low Voltage Controlled) Dimming Drivers
1. Must meet IEC 62386

KK. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
1. Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address)
2. Capable of signal interpolation and smoothing of color and intensity transitions

INSTALLATION

LL. To be installed per manufacturers prescribed methods.

MM. Driver may be remote mounted up to 300 ft. (100 m) depending on power level and wire gauge.

NN. 0-10V input shall be protected from line voltage miswire, and shall be immune and output unresponsive to induced AC voltage on the control leads.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - **GENERAL**

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior wall mounted luminaires.
2. Luminaire-mounted photoelectric relays.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.3 ACTION SUBMITTALS

A. Product Data: For each luminaire, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
8. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program 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.

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 IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.
    b. Color: Match Architect's sample of manufacturer's standard color.
    c. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Dark bronze.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers. Labels shall be located 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 and drivers characteristics:

    a. "USES ONLY" LED Lamps and drivers.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 GROUNDING

A. Ground metal poles and support structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each Bollard unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-64, "Photometric Measurements of Parking Areas."
b. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.

b. NICET-certified fire-alarm technician, Level III minimum.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

a. Frequency of testing of installed components.
b. Frequency of inspection of installed components.
c. Requirements and recommendations related to results of maintenance.
d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

I. 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.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing 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.

1.6 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Amseco - a Potter brand; Potter Electric Signal Company.
2. Bosch Security Systems.
3. Commercial Products Group/CPG Life Safety Signals.
4. Faraday; Siemens Building Technologies, Inc.
5. Federal Signal Corporation.
6. Fire Control Instruments, Inc.; a Honeywell company.
7. Fire Lite Alarms; a Honeywell company.
8. Gamewell; a Honeywell company.
9. GE Infrastructure; a unit of General Electric Company.
10. Gentex Corporation.
11. Harrington Signal, Inc.
12. NOTIFIER; a Honeywell company.
13. Siemens Building Technologies, Inc.; Fire Safety Division.
14. Silent Knight; a Honeywell company.
15. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices.

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.
7. Fire-extinguishing system operation.
8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
5. Recall elevators to primary or alternate recall floors.
6. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

    a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 1 2 3 line(s) of 40 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

   a. Initiating Device Circuits: Style D
   b. Notification Appliance Circuits: Style Z.
   c. Signaling Line Circuits: Style 6.
   d. Install no more than 50 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

   a. Initiating Device Circuits: Style A
   b. Notification Appliance Circuits: Style W
   c. Signaling Line Circuits: Style 4.
   d. Install no more than 50 addressable devices on each signaling line circuit.

D. Notification Appliance Circuit: Operation shall sound in a pattern.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium

H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type. With integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. 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.
3. Station Reset: Key- or wrench-operated switch.
4. 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.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

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 shall 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 shall 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.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall 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, shall 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.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall 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, shall 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.
4. Each sensor shall 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: Rated to interrupt fan motor-control circuit.

2.6 NONSYSTEM SMOKE DETECTORS

A. Single-Station Smoke Detectors:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Auxiliary Relays: One [Form C rated at 0.5 A] Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
3. Visible Notification Appliance: 177-cd strobe.
4. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and fixed temperature.
5. Test Switch: Push to test; simulates smoke at rated obscuration.
6. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
7. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
8. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
9. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.

    a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.

3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.

    a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of [135 deg F (57 deg C)] or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C)

1. Mounting: [Twist-lock base interchangeable with smoke-detector bases].
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 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. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) 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 shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, [white].

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.

2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Division 3 Section.

C. Retain first subparagraph below if Project requires seismic bracing. Coordinate with Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

1. Install seismic bracing. Comply with requirements inDivision 16 Section "Vibration and Seismic Controls for Electrical Systems."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

E. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

F. 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 equipment to existing monitoring equipment at the supervising station.

G. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

J. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

K. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

M. Device Location-Indicating Lights: Locate in public space near the device they monitor.

N. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

O. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 8 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to elevator recall system and components.
3. Alarm-initiating connection to activate emergency lighting control.
4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt trip breaker.
8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
9. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION