PROJECT MANUAL

STUDIO 8 DESIGN PROJECT NUMBER - 220006.01

A HOUSING FACILITY FOR NEWBERRY COUNTY DETENTION CENTER
NEWBERRY, SOUTH CAROLINA

OWNER

NEWBERRY COUNTY
1309 COLLEGE STREET
NEWBERRY SC 29108

PROJECT MANAGER

CLAYTON

CLAYTON CONSTRUCTION
121 VENTURE BLVD. SUITE A
SPARTANBURG, SC 29306

STUDIO 8 design architecture

ARCHITECT

James Ingram, AIA/NCARB

Telephone No. (229) 2441188
FAX No. (229) 253-0004
2722 North Oak Street
Valdosta, GA 31602
jingram@s8darchitects.com

June 25, 2025

A HOUSING FACILITY FOR NEWBERRY COUNTY DETENTION CENTER
NEWBERRY, SOUTH CAROLINA

SPECIFICATIONS
TABLE OF CONTENTS

June 25, 2025

END

SECTION 001113 - ADVERTISEMENT FOR BIDS

1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified bidders may submit bids for project as described in this Document. Submit bids according to the Instructions to Bidders.

1. Regulatory Requirements: Newberry County Procurement shall govern submittal, opening, and award of bids.

B. Project Identification: **A Housing Facility for Newberry County Detention Center**

1. Project Location: **3239 Louis Rich Road, Newberry, SC 29108**

C. Owner: **Newberry County**

1. Owner's Representative: **Crystal Waldrop, Purchasing Director, 1309 College Street, Post Office Box 156, Newberry S.C. 29108, Ph: (803) 321-2100**

D. Architect/Engineer: **James Ingram, AIA, Studio 8 Design, LLC, 2722 North Oak St., Valdosta, Georgia 31602, Ph: (229)-244-1188.**

E. Construction Manager: **Adam Failla, Project Manager, Clayton Construction, 121 Venture Blvd. Suite A, Spartanburg, SC 29306, Ph: (864) 576-1901**

F. Project Description: Construction of a housing facility on the site of the exisiting Newberry County Detention Center. The building includes a pre-engineered metal building enclosing prefabricated metal cells with concrete masonry wall completing the interior. The building will be complete with HVAC, plumbing, electrical, and electronics systems.

G. Construction Contract: Bids will be received for the following Work:

1. General Contract (all trades) as described in the Construction Documents and Project Specifications.

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed lump sum bids until the bid time and date at the location given below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: **July 31, 2025.**
2. Bid Time: **2:00 p.m.**, local time.
3. Location: **Newberry County Courthouse Annex Conference Room, 1309 College Street, Newberry S.C. 29108**

B. Bids will be thereafter publicly opened and read aloud.

1.3 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of **5** percent of the bid amount. No bids may be withdrawn for a period of **60** days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID MEETING

A. Pre-bid Meeting: A **MANDATORY** Pre-bid meeting for all bidders will be held at **Newberry County Detention Center, 3239 Louis Rich Road #D, Newberry, SC on July 15, 2025 at 2:00 pm.**, local time. Prospective prime bidders **must** attend.
   1. Bidders' Questions: Architect will provide responses to bidders' questions received up to **5:00p.m. on July 21, 2025 and will be addressed in an Addendum. All questions must be received in writing and only written responses will be issued. Verbal questions and responses are non-binding.**

1.5 DOCUMENTS

A. Bidding documents may be obtained through Studio 8 Design, LLC, in Valdosta, GA, 229-244-1188. Please email Sharon Flythe: **sflythe@s8darchitects.com**. Bidders are cautioned that acquisition of Bidding Documents through any other source other than Studio 8 Design, LLC is not advisable. Acquisition of Bidding Documents from unauthroized sources places the bidder at risk of receiving incomplete or inaccurate information upon whict to base the bid.

1.6 TIME OF COMPLETION **AND LIQUIDATED DAMAGES**

A. Successful bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. **Work is subject to liquidated damages in the amount of$200/day past the anticipated construction time of sixteen (16) months.**

1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. **A Performance Bond, separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.**

END OF DOCUMENT 001113

SECTION 011000 - SUMMARY

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. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

B. Related Requirements:

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

1.3 PROJECT INFORMATION

A. Project Identification: A Housing Facility for Newberry County Detention Center

1. Project Location: 3239 Louis Rich Rd., #D, Newberry, South Carolina

2. Owner: Newberry County

3. Owner's Representative: Crystal Waldrop, Purchasing Director

4. Project Manager: Adam Failla, Clayton Construction

B. Architect and Engineer: Studio 8 Design, LLC
James, Ingram, AIA, Architect

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work is defined by the Contract Documents and consists of the following:
Construction of a housing facility on the site of the exisiting Newberry County Detention Center. The building includes a pre-engineered metal building enclosing prefabricated metal cells with concrete masonry wall completing the interior. The building will be complete with HVAC, plumbing, electrical, and electronics systems.

B. Type of Contract:

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

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.6 ACCESS TO SITE

A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to parking areas, detention pond and new construction areas. Existing facility parking areas will be off limits unless coordinated with the Owner.
2. Limits: Limit site disturbance to the area identified as “Limits of Disturbance” as shown on the construction documents.
3. Driveways, Walkways and Entrances: Keep driveways, parking areas, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
4. Construction Parking and Laydown: Coordinate with the Owner. There is an adjacent lot that can be utilized for material laydown and construction personnel parking.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will partial occupy site and adjacent building during portions of the construction period. Cooperate with Owner during construction operations to minimize

conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Coordinate with Owner prior to commencement.
2. Early Morning Hours: Coordinate with Owner prior to commencement.
3. Hours for Utility Shutdowns: Coordinate with Owner prior to commencement.

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

1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Architect's and Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

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

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is **not** permitted.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.10 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

COUNTY OF NEWBERRY
Purchasing Department, Post Office Box 156, Newberry, SC 29108
Ph: (803) 321-2100 / Fax: (803) 321-2102

INVITATION FOR BIDS

BID NUMBER: **2025-12**

OPENING DATE AND TIME: **July 31, 2025 at 2:00pm**

SUBMITTAL ADDRESS: Newberry County Courthouse Annex Conf. Room
1309 College Street, Newberry (Hand Delivered)
Post Office Box 156, Newberry SC 29108
(US Postal Service Delivered)

PROCUREMENT FOR: **A HOUSING FACILITY FOR NEWBERRY COUNTY DETENTION CENTER NEWBERRY, SOUTH CAROLINA**

Subject to the conditions, provisions and the enclosed specifications, sealed bids will be received at this office until the stated date and time and then publicly opened. Any bid received after the scheduled deadline, will be immediately disqualified. The County assumes no responsibility for the delivery of bids which are mailed. BID NUMBER MUST BE SHOWN ON THE OUTSIDE OF ENVELOPE.

DIRECT ALL INQUIRIES TO:

Studio 8 Design, LLC
James Ingram, AIA/NCARB
2722 North Oak Street
Valdosta, GA 31602 229.244.1188
jingram@s8darchitects.com

NOTICE TO BIDDERS: Each bidder shall fully acquaint himself with conditions relating to the scope and restrictions attending the execution of the work under the conditions of this bid. The failure or omission of a bidder to acquaint himself with existing conditions shall in no way relieve him of any obligation with respect to this bid. All amendments to and interpretations of this solicitation shall be in writing and issued by the Purchasing Director of the County. Newberry County shall not be legally bound by an amendment or interpretation that is not in writing.

SECTION 011600 – BIDDERS SCHEDULE

COUNTY OF NEWBERRY
Purchasing Office, 1309 College Street, Post Office Box 156, Newberry S.C. 29108
Ph: (803) 321-2100 / Fax: (803) 321-2102

BIDDERS SCHEDULE

BID NUMBER: **2025-12**

OPENING DATE AND TIME: **July 31, 2025 at 2:00pm**

OPENING LOCATION: Newberry County Courthouse Annex, Conference Room
1309 College Street, Newberry, SC 29108

PROCUREMENT:

1.1 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Front-end Specifications, and all subsequent Addenda, as prepared by Johnson Laschober & Associates (JLA) and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated base bid sum of:

1. _____ Dollars ($_____).

1.2 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____. (if applicable)

1.3 BID GUARANTEE - Bids shall be good for sixty (60) days from the date of submittal

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within [**10**] days after a written Notice of Award, if offered within [**60**] days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond (AIA Document A310).

1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect and shall fully complete the Work within six months **[480]** calendar days.

1.5 BID SUPPLEMENTS

A. The following supplements are a part of this Bid and are included in this document.

1. Bid Form Supplement - Bid Bond Form (AIA Document A310) or Cashier’s check.

1.6 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in Newberry, South Carolina, and that all fees, permits, etc., pursuant to submitting this proposal have/will been/be paid in full.

1.7 SUBMISSION OF BID

A. Respectfully submitted this _____ of 2025.

CONTRACTOR: _____ SIGNATURE: _____

Name of Authorized Contact: _____

Email Address: _____

Address: _____

Phone & Fax: _____

FEIN: _____

Contractor's SC License #: _____

SECTION 011700 – INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

INSTRUCTIONS TO BIDDERS

1. Only one copy of bid is required unless otherwise specified.

2. Bids, amendments thereto or withdrawal request must be received by the time advertised for bid openings to be timely filed. It is the vendor's sole responsibility to ensure that these documents are received by the purchasing office at the time indicated in the bid document.

PLEASE NOTE THE VENDOR IS ULTIMATELY RESPONSIBLE FOR VERIFYING THEY HAVE RECEIVED ANY/ALL ADDENDA PRIOR TO THE BID OPENING.

3. When specifications or descriptive papers are submitted with the bid, enter the bidder's name thereon.

4. Submit your signed bid on the bidder's schedule provided. Show the bid number on envelope as instructed and the bid name or description. Newberry County accepts no responsibility for unmarked or improperly marked envelopes.

5. Bidders must clearly mark as "Confidential" each part of their bid which they consider to be proprietary information that could be exempt from disclosure under Section 30-4-40 Code of Laws of South Carolina, 1976, as amended, (also known as the Freedom of Information Act). The County reserves the right to determine whether this information should be exempt from disclosure and no legal action may be brought against the County or its agents for its determination in this regard.

6. By submission of a bid, you are guaranteeing that all goods and services meet the requirements of the solicitation during the contract period.

7. Tie bids will be resolved in accordance with the provisions of the Newberry County Purchasing Ordinance.

8. A copy of the bidder's W-9 shall be included in the submission.

GENERAL PROVISIONS

1. The County of Newberry reserves the right to reject any and all bids, to cancel a solicitation, and to waive any technicality if deemed to be in the best interest of the County.

2. Unit prices will govern over extended prices unless otherwise stated in this bid invitation.

3. **PROHIBITION OF GRATUITIES:** South Carolina law and the Newberry County Purchasing Ordinance prohibit the giving of anything of value in return for favors or other preferential treatment in the purchasing process. Bidders should govern themselves accordingly.

4. **BIDDERS QUALIFICATION:** Bidders must, upon the request of the county, furnish satisfactory evidence of their ability to furnish products or services in accordance with the terms and conditions of these specifications. The County reserves the right to make the final determination as to the bidder's ability to provide the products or services requested herein. Bidder determined to be irresponsible bidders are not allowed to bid to provide the County goods or services.

5. **BIDDERS RESPONSIBILITY:** Each bidder shall fully acquaint himself with conditions relating to the scope and restrictions attending the execution of the work under the conditions of this bid. It is expected that this will sometimes require on-site observation. The failure or omission of a bidder to acquaint himself with existing conditions shall in no way relieve him of any obligation with respect to this bid or to the contract.

6. **AWARD CRITERIA:** The contract shall be awarded to the lowest responsible and responsive bidder(s) whose bid meets the requirements and criteria set forth in the Invitation for Bid. Award may be made to one or a multiple of bidders, whichever deems to be in the best interest of the County, or unless otherwise stated on the bidder's schedule.

7. **WAIVER:** The County reserves the right to waive any Instruction to Bidders, General or Special Provisions, General or Special Conditions, or specifications deviation if deemed to be in the best interest of the county.

8. **COMPETITION:** This solicitation is intended to promote competition. If any language, specifications, terms and conditions, or any combination thereof restricts or limits the requirements in this solicitation to a single source, it shall be the responsibility of the interested vendor to notify the Purchasing Director on in writing within five (5) days prior to the opening date. The solicitation may or may not be changed but a review of such notification will be made prior to the award.

9. **REJECTION:** Ambiguous bids which are uncertain as to terms, delivery, quantity, or compliance with specifications may be rejected or otherwise disregarded if such action is in the best interest of the County.

10. **RIGHT TO PROTEST**: Any prospective bidder, offeror, or contractor, who is aggrieved in connection with the solicitation of a contract shall protest in writing to the Purchasing Director within ten (10) calendar days of the date of issuance of the Invitation to Bid or other solicitation documents, whichever is applicable, or any amendment thereto, if the amendment is at issue. Any actual bidder, offeror, or contractor, who is aggrieved in connection with the intended award or award of a contract, shall protest in writing to the purchasing director within ten (10) calendar days of the notification of intent to award or statement of award.

11. **PROTEST PROCEDURE:** A protest shall be in writing, submitted to the purchasing director, and shall set forth the specific grounds of the protest with enough particularity to give notice to the issues to be decided.

GENERAL CONDITIONS

1. **DEFAULT:** In case of default by the contractor, the County reserves the right to purchase any or all items in default in the open market, charging the contractor with any excessive costs. Should such charge be assessed, no subsequent bids of the defaulting contractor will be considered until the assessed charge has been satisfied.

2. **NON-APPROPRIATION:** Any contract entered into by the County resulting from this bid invitation shall be subject to cancellation without damages or further obligation when funds are not appropriated or otherwise made available to support continuation of performance in a subsequent fiscal period or appropriated year.

3. **HOLD HARMLESS AND INSURANCE**: The successful bidder shall indemnify and hold harmless the County of Newberry and all County officers, agents and employees against all suits or claims for personal injury or property damage resulting from, or arising from, the successful bidder's performance of the contract, as well as against any suits or claims of any character brought against the County or its agents or employees by reason of any claim of infringement of any patent, trade mark, trade dress, or copyright, including reimbursement to the County for all attorneys fees and court costs incurred by the County in defending itself or its agents or employees against any such claim or suit. **In addition, the successful bidder will maintain a public liability policy with minimum limits of $500,000 per occurrence, or $1,000,000 single limit, for damages arising from acts which occur during the contract period, with the County of Newberry named as an**

additional insured on the policy; the successful bidder shall also maintain workers compensation and vehicle liability insurance in the amounts required by statutory law. Proof of such coverage will be provided upon demand or as otherwise provided in the bid specifications.

4. **CONTRACT ADMINISTRATION:** Questions or problems arising after award of this contract shall be directed to the Purchasing Director, P.O. Box 156, Newberry, SC 29108, or by calling 803-321-2100.

5. **FORCE MAJEURE:** The Contractor shall not be liable for any excess costs if the failure to perform the contract arises out of causes beyond the control and without fault or negligence of the contractor. Such causes may include, but are not restricted to acts of God or of a public enemy, acts of Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the contractor. If the failure to perform is caused by default of a subcontractor, and if such default arises out of causes beyond the control of both the contractor and subcontractor and without excess costs for failure to perform, unless the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the contractor to meet the required delivery schedule.

6. **PUBLIC RELEASE:** Contractor agrees not to refer to award of this contract in commercial advertising in such a manner as to state or imply that the products or services provided are endorsed or preferred by the User.

7. **QUALITY OF PRODUCT:** Unless otherwise indicated in this bid it is understood and agreed that any items offered or shipped on this bid shall be new, in first class condition, and without defect that all containers shall be new and suitable for storage or shipment, and that prices include standard commercial packaging and shipping to the specified destination in Newberry County. No demonstration models shall be sold as new, without prior written permission of the County.

8. **S.C. LAW CLAUSE:** Upon award of a contract under this bid, the person, partnership, association or corporation to whom the award is made must comply with the laws of South Carolina which require such person or entity to be authorized and/or licensed to do business with this State. Notwithstanding the fact that applicable statutes may exempt or exclude the successful bidder from requirements that it be authorized and/or licensed to do business in this State, by submission of this signed bid, the bidder agrees to subject himself to the jurisdiction and process of the courts of the State of South Carolina as to all matters and disputes arising or to arise under the contract and the performance thereof, including any questions as to the liability for taxes, licenses, or fees levied by the State.

9. **ASSIGNMENT:** No contract or its Provisions may be assigned, sublet, or transferred without the written consent of the Purchasing Director.

10. **AFFIRMATIVE ACTION:** The successful bidder will take affirmative action in complying with all Federal and State requirements concerning fair employment of the handicapped, and concerning the treatment of all employees, without regard or discrimination by reason of race, color, religion, sex, national origin or physical handicap.

11. **DELIVERIES:** All deliveries shall be FOB Destination. It is agreed by the parties hereto that delivery by the contractor to the common carrier does not constitute delivery to the County. Any claim for loss or damage shall be between the contractor and the carrier.

12. **APPROPRIATE S.C. SALES TAXES, FEES AND PERMITS** shall be included in the Contractor's base bid for all materials. All fees, including permits and any removal or disposal of construction debris shall be included in the contractor's bid.

13. **PAYMENT TERMS:** Payment will be made when all work is completed and accepted by Newberry County as meeting the specifications here within. These payments shall be submitted on a monthly basis as payment applications, with the final payment to be the release of retainage once all work is satisfactorily completed.

14. **BID BOND:** For each bid in excess of $25,000.00 each bidder will submit with their bid a bond in the amount of 5% of the total price of the bid submitted. The bid bonds will be returned to the unsuccessful bidders once the county accepts the lowest most responsive bid. If the most responsive bidder fails to perform the responsibility of the bid within 10 days of the award, then the bid bond will be forfeited to the county as liquidated damages and the next lowest bidder will be awarded the bid. Bid bonds may be in the form of a surety, a cashier's check or an unconditional letter of credit in favor of Newberry County issued by a commercial bank in South Carolina.

15. **PERFORMANCE AND PAYMENT BONDS:** The chosen vendor will be required to submit to the County both a performance bond and payment bond in the amount of 100% of the contract price before commencing with the work. **Both bonds will be issued from a surety company with an "A" minimum rating of performance as stated in the most current publication of Best Key Rating Guide, Property Liability.**

16. **Compliance with The South Carolina Illegal Immigration Act**: By submitting an offer, Bidder certifies that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina code of Laws (originally enacted as Section 3 of The South Carolina Illegal Immigration act, 2008 S.C. Act No. 280) and agrees to

provide upon request any documentation required to establish either: (a) the applicability of Title 8, Chapter 14 to Bidder and any subcontractor or sub-subcontractors; or (b) the compliance with Title 8, Chapter 14 by Bidder and any subcontractors or sub-subcontractors. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both". Bidder agrees to include in any contracts with its subcontractors language requiring the subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in any contracts with the sub-subcontractors language requiring the sub-subcontract to comply with the applicable requirements of Title 8, Chapter 14.

END OF SECTION 011700

STATE OF SOUTH CAROLINA) CONSTRUCTION AGREEMENT

COUNTY OF NEWBERRY)

This AGREEMENT is made and entered into on this ____ day of ____2025, by and between the County of Newberry, a political subdivision of the State of South Carolina, having its principal place of business at 1309 College Street, Newberry, SC 29108 ("County"), and _____("Contractor").

In consideration of the covenants hereinafter set forth, the parties mutually agree as follows:

1. CONTRACT PERIOD. This Agreement shall begin on the effective date of this agreement and shall remain in effect until completion of work as stated in Invitation for Bid ("IFB")#2025-12, A Housing Facility for Newberry County Detention Center.

2. SCOPE OF SERVICES. County is employing Contractor to provide all labor to demolish and remove and add to the existing systems as specified in solicitation. The scope of services to be provided by Contractor is set forth more fully in the County Invitation for Bid ("IFB") #2025-12.

3. PRICE. County agrees to pay Contractor a total sum not to exceed_____, unless agreed upon by both parties.

4. STANDARD OF CARE. Services performed by Contractor will be conducted in a manner consistent with that level of care and skill exercised by members of the profession with Contractor's experience and qualifications currently providing similar services.

5. PAYMENT TERMS. Payments shall be made to Contractor when work has been completed and accepted by Newberry County as meeting the scope of work described within in the solicitation. These payments shall be submitted on a monthly basis as payment applications, with the final payment to be the release of retainage once all work is satisfactorily completed.

6. Successful bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. **Work is subject to liquidated damages in the amount of $200/day past the anticipated construction time of 480 Calendar Days.**

7. **NON-APPROPRIATION. It is understood and agreed by the parties that in the event funds are not appropriated in the current fiscal year or any subsequent fiscal years, this contract will become null and void and the County will only be required to pay for services completed to the satisfaction of the County. As stated in Section 34.86 of the Procurement Ordinance such a clause essentially provides that if a future Council fails to appropriate sufficient funds to meet a contractual obligation for that future budget year, the contract can be terminated without penalty to the County, and without limiting the County's ability to appropriate other funds for the provision of similar goods or services in that future budget year or years.**

8. WARRANTY. Contractor warrants to County that all services and labor furnished to progress the work under this contract will be performed in accordance with the standard of care and diligence normally practiced by recognized firms of this type in performing services of a similar nature, free from defects which would not normally be found in work of this nature, and that the work will be of good quality, and in strict conformance with this contract. All work not conforming to these requirements may be considered defective. As per bid specifications, and contractor's response to bid specifications, special warranties will be incorporated into this contract.

9. INSURANCE AND BONDING.

The contractor shall not commence work under this contract until it has obtained all insurance required, and such insurance has been approved in writing by the County, nor shall the contractor allow any subcontractor to commence work on its subcontract until all similar insurance required of the subcontractor has been obtained. All insurance policies shall be maintained for the life of the contract.

A. THE COUNTY SHALL BE NAMED AS "ADDITIONAL INSURED" FOR IT'S INTEREST on all policies of insurance, except Worker's Compensation, Automobile Liability regarding ongoing operations, products and completed operations, and this shall be noted on the face of the Certificate of Insurance.

B. Certificates for all such policies of insurance shall be provided by the contractor's insurance agent or broker to the County prior to the Notice to Proceed. Accordingly, Performance and Payment Bonds shall also be provided in the amount of 100% of the contract before commencement of work.

C All Certificates of Insurance submitted shall provide on the face of the certificate reference to County's IFB #2025-3.

D. Contractor will provide County a minimum of 30 days advance notice in the event the insurance policies (or an insurance policy) are canceled.

E. Subcontractors approved to perform work on this project are subject to all of the requirements in this Section.

F. Contractor agrees to maintain and keep in force during the life of this Agreement, with a company or companies authorized to do business in South Carolina, the following insurance policies:

Comprehensive General Liability:

$1,000,000 per occurrence - combined single limit / $2,000,000 general aggregate, to include products and completed operations.

Automobile Liability:

$1,000,000 per occurrence - combined single limit (Coverage shall include bodily injury and property damage and cover all vehicles including owned, non-owned and hired)

Statutory Worker's Compensation:

Coverage A - State of SC

Coverage B - Employers liability

$1,000,000 Each Accident

$1,000,000 Disease, Per Employee

$1,000,000 Disease, Policy Limit

No deviation from these coverages will be accepted unless, in the County's sole discretion, it is more advantageous to the County, i.e., $1,000,000 - a $2,000,000 or $5,000,000 limit would be acceptable.

10. INDEMNIFICATION. Contractor agrees to defend, indemnify and save harmless the County and all County officers, agents and employees from and against any loss, damage, claim or action, including all expenses incidental to such claim and action, to the extent arising from any negligent acts or omissions by Contractor, its agents, staff, consultants and contractors employed by it, in the performance of the services under this Agreement. Contractor shall not be responsible for any loss, damage, or liability to the extent arising from acts of the County, its agents, staff, and other consultants employed by it.

11. RIGHT OF ENTRY. The County will provide for the right of entry for Contractor, its subcontractors, and all necessary equipment in order to complete the work under this Agreement. Contractor agrees to be responsible for any damage to

property that is caused by Contractor, its subcontractors and/or equipment and further agrees to take all necessary corrective action for any damage to property that is caused by Contractor, its subcontractors and/or equipment.

12. CONTROL OF JOB SITE AND ACTIVITY. Contractor shall be responsible for its activities, that of its employees on the site and the activities of its consultants, contractors and/or subcontractors for maintaining a safe job site.

13. COMPLIANCE WITH CODES AND STANDARDS. Contractor's professional services shall incorporate those federal, state and local laws, regulations, codes and standards that are applicable at the time Contractor rendered its services. Contractor shall not be responsible for any claim or liability for injury or loss allegedly arising from Contractor's failure to abide by federal, state or local laws, regulations, codes and standards that were not in effect or publicly announced at the time Contractor rendered its services.

14. ILLEGAL IMMIGRATION REFORM ACT COMPLIANCE. By submitting an offer, Contractor certifies that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws (originally enacted as Section 3 of The South Carolina Illegal Immigration Reform Act, 2008 S.C. Act No. 280) and agrees to provide upon request any documentation required to establish either: (a) the applicability of Title 8, Chapter 14 to Contractor and any subcontractors or sub-subcontractors; or (b) the compliance with Title 8, Chapter 14 by Contractor and any subcontractor or sub-subcontractor. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its sub-contractor's language requiring the subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in any contracts with the sub-sub-contractor's

language requiring the sub- subcontractor to comply with the applicable requirements of Title 8, Chapter 14. In the event any contractor, subcontractor and/or sub-subcontractor is found not to be in compliance with the SC Immigration Reform Act [hereinafter "The Act"], the contractor agrees to fully indemnify the County for any loss suffered by the County as a result of such contractor, subcontractor or sub-subcontractor's failure to comply with the Act.

15. PUBLIC RESPONSIBILITY. The County has a duty to conform to applicable codes, standards, regulations and ordinances with regard to public health and safety. Contractor will at all times alert the County to any matter of which Contractor becomes aware and believes requires the County to issue a notice or report to certain public officials, or to otherwise conform with applicable codes, standards, regulations or ordinances. If the County decides to disregard Contractor’s recommendations in these respects, Contractor shall employ its best judgment in deciding whether or not it should notify public officials.

16. CLIENT LITIGATION. Contractor agrees to produce documents, witnesses and/or general assistance to any litigation, arbitration or mediation involving the County, if the County requests such documents, witnesses and/or general assistance. The County shall reimburse Contractor for all direct expenses incurred and time according to Contractor’s rate schedule as of the date of the execution of this Agreement.

17. CONFIDENTIALITY. Contractor will maintain as confidential any documents or information provided by the County and will not release, distribute or publish same to any third party without prior permission from the County, unless compelled by law or order of a court or regulatory body of competent jurisdiction. Such release will occur only after prior notice to the County.

18. NOTICES. All notices made pursuant to this Agreement shall be in writing and delivered personally or sent by registered or certified mail, return receipt requested, to the parties at their respective addresses set forth below:

COUNTY	CONTRACTOR
Jeff Shacker, County Administrator County of Newberry 1309 College Street Newberry SC 29108	ABC Contractor

Any party may change the person to whom notices are to be sent by giving ten (10) calendar days written notice of such change to the other party.

19. TERMINATION. This contract is subject to termination for failure to comply with the specifications, terms and conditions by the County or the Contractor upon written notice by registered mail. Such termination will be effective not less than ten (10) days nor more than sixty (60) days after Contractor's receipt of such notice from the County, nor less than thirty (30) days nor more than sixty (60) days after receipt by the County from the Contractor. Receipt of notice by one party to terminate the contract will nullify any subsequent reciprocal notice by the receiving party prior to the announced termination date. In the event of termination, the County shall be responsible to pay the Contractor only for work satisfactorily completed upon the effective date of termination, and the County shall not be responsible for any other charges.

Should the County fail to make payment on any undisputed invoice amount within sixty (60) business days upon receipt of such invoice, Contractor may elect to either suspend the services provided or terminate this Agreement; provided, however, prior to termination, the County shall be given notice of the default and an opportunity to cure such default within seven (7) business days after receipt of the notice of default. Should this Agreement be terminated by Contractor, Contractor shall be entitled to be paid only for the services actually completed to the satisfaction of the County as of the date of termination.

The County may terminate this contract for convenience by providing sixty (60) calendar days advance written notice to the Contractor.

This Agreement may also be terminated pursuant to the pertinent portions of Section 7 herein.

This Agreement may also be terminated by the prior written mutual consent of both parties.

20. CONTRACT DOCUMENTS. This Agreement, along with the provisions contained in County IFB #2025-12 and Contractor's Response to County IFB #2025-12 represents the entire agreement between the parties and supersedes any and all prior agreements, whether written or oral, that may exist between the parties regarding same. If there is a conflict between any of the terms of these contract documents the order of precedence of these contract documents shall be;

A. Any amendment signed after the execution date of this agreement;

B. This Agreement;

C. Contractor's Response to County IFB #2025-12;

D. County IFB #2025-12;

21. ASSIGNMENT. This Agreement may not be assigned by either party without the prior written consent of the other party.

22. SEVERABILITY. Should any section, paragraph, clause, phrase, or provision of this Agreement be determined invalid or held unconstitutional by a court of competent jurisdiction, such declaration shall not affect the validity of this Agreement as a whole or any part or provision thereof, other than the part so decided to be invalid or unconstitutional.

23. APPLICABLE LAW AND VENUE. The construction, interpretation and performance of this Agreement shall be governed by and construed in accordance with the laws of the State of South Carolina.

The County and Contractor further agree that this Agreement shall be deemed to be made and performed in Newberry County, South Carolina. For the purposes of venue, all suits or causes of

action arising out of this Agreement shall be brought in the courts of Newberry County, South Carolina.

24. AFFIRMATIVE ACTION: Contractor will take affirmative action in complying with all Federal and State requirements concerning fair employment of the handicapped, and concerning the treatment of all employees, without regard or discrimination by reason of race, color, religion, sex, national origin or physical handicap.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

WITNESSES: CONTRACTOR

_____ By: _____

_____ Its: _____

NEWBERRY COUNTY

By:_____ By: _____

Title:_____ Title: _____

ATTEST: _____

SECTION 012100 - ALLOWANCES

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 administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.
5. Testing and inspecting allowances.

C. Related Requirements:
1. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

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

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

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

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

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

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

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

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM, UNIT-COST, AND QUANTITY ALLOWANCES

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

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

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

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 CONTINGENCY ALLOWANCES

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

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

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

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

1.9 TESTING AND INSPECTING ALLOWANCES

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

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

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

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

1.10 ADJUSTMENT OF ALLOWANCES

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

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. **Allowance No. 1**: Owner Contingency Allowance: Include a contingency allowance of **$180,000** including overhead and profit for use according to Owner's written instructions.

Allowance No. 2: Testing Allowance: Include a testing allowance of $140,000.00 for Construction Testing and Special Inspections.

Allowance No. 3: FF&E Allowance: Include a furniture, fixture, and equipment allowance of $100,000.00 for the Owner's purchases for the new building.

END OF SECTION 012100

SECTION 012500 - SUBSTITUTION PROCEDURES

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 administrative and procedural requirements for substitutions.

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

1.3 DEFINITIONS

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

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

1.4 ACTION SUBMITTALS

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

   1. Substitution Request Form: Use CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

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

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

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

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

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

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

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

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 administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

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

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

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

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

e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or forms acceptable to Architect.

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

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Rain Day Adjustment: If a Contractor requests, a time extension may be granted of one day for each day that the actual number of rain days (precipitation 0.1 inches) in excess of the Mean Number of Days of Precipitation of 0.1 Inches or More as listed below occurs based on actual data gathered on site or that available from the South Carolina Climatology Office, plus impact days to the extent said impact could not be mitigated by the Contractor and/or its subcontractors by reasonable and prudent construction means and methods. The Mean Number of Days of Precipitation of 0.1 Inches or More as follows:

January 6 Days
February 6 Days
March 7 Days
April 5 Days
May 6 Days
June 8 Days
July 9 Days
August 9 Days
September 6 Days

October 4 Days
November 4 Days
December 6 Days

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on appropriate EJCDC document.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 or EJCDC Document C-940. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

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

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with continuation sheets.
    b. Submittal schedule.
    c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect through at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

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

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703 or respective EJCDC document.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.
2) Materials.
3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

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

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

C. Payment Application Times: Submit Application for Payment to Architect each month. The period covered by each Application for Payment is one month, ending on the last day of the month.

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

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

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

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

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

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

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

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

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

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

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 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. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number 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.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 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. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

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

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

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

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

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

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

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working 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 of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

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

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

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will 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. Conduct the conference to review responsibilities and personnel assignments.
2. 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.

3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

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

    a. Contract Documents.
    b. Options.
    c. Related RFIs.

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

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

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.

f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly or regular 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) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.

16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) 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.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.

13) Quality and work standards.
14) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

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

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

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

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

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

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

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

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

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

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

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.
g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.

m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

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

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

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

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

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

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

3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

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

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

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

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

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.
    b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data , unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.
    b. Two opaque (bond) copies of each submittal. Architect will return one copy. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.

    a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
    b. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

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

    a. Generic description of Sample.
    b. Product name and name of manufacturer.

c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

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

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

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

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

   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

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

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

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.

2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.
    b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

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

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

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

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

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

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

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 administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups (where required) : Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate

compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

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

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

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

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

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

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

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

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

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

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

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

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.8 QUALITY ASSURANCE

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

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

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

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

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

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

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

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

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

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

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

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.9 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including

service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

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

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

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

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

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

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

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

3.2 REPAIR AND PROTECTION

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

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

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

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

END OF SECTION 014000

SECTION 014200 - REFERENCES

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 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

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

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

1.4 ABBREVIATIONS AND ACRONYMS

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

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

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).

27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).

68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA - Electronic Components Industry Association; www.eciaonline.org
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.
103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).
144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.

155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tileroofing.org.
191. UBC - Uniform Building Code; (See ICC).
192. UL - Underwriters Laboratories Inc.; www.ul.com.
193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
194. USAV - USA Volleyball; www.usavolleyball.org.
195. USGBC - U.S. Green Building Council; www.usgbc.org.
196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.

197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
204. WPA - Western Wood Products Association; www.wwpa.org.

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

1. DIN - Deutsches Institut f?r Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; http://dodssp.daps.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

B. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.3 QUALITY ASSURANCE

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

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.4 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

PART 3 - EXECUTION

3.1 TEMPORARY ACCOMMODATIONS

A. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.2 SITE USE COORDINATION

A. General: Comply with the following:

B. Traffic Controls: Comply with requirements of authorities having jurisdiction (AHJ).

1. Protect existing site improvements including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary parking areas for construction personnel in accordance with AHJ.

3.3 SECURITY AND PROTECTION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

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

C. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints.

2. Provide walk-off mats at each entrance through temporary partition.

E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

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 administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for requests for substitutions.
   2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.

Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - 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 and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

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

1.4 QUALITY ASSURANCE

A. 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, 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. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

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. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

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.

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

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, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.

4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

A. General: 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 (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful 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 work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, 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. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. 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 minimize interruption to occupied areas.

G. 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.

H. 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. 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 minimize 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. 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.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. General: 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, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

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 assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements of Manufacturer’s Recommendations.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 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. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE DISPOSAL

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 administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition waste.
2. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste become property of Contractor.

B. Mechanical units to be removed to be offered to owner.

C. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

PART 2 - EXECUTION

2.1 WASTE HANDLING

A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste removed during the entire duration of the Contract.

B. Site Access and Temporary Controls: Conduct waste operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

2.2 DISPOSAL OF WASTE

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

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

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 administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

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

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

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 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, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance 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 heat and other utilities.
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, including touchup painting.
10. Touch up 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 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 according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, 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. MS Excel electronic file. Architect will return annotated file.
    b. PDF electronic file. Architect will return annotated file.
    c. Three paper copies. Architect will return two copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Contractor warrants the Project will be habitable and constructed in a good and workmanlike manner and free from defects in material and workmanship for a period of **one** year following the date of Substantial Completion. This warranty in no way affects the individual product warranties of specified products that extend past the first year as so noted in other sections of the specifications.

B. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

C. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

D. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Remove snow and ice to provide safe access to building.
f. 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.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. 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.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

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 administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed 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 operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. 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's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

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."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: 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 shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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. 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: Enable bookmarking of 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.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. 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.

C. 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.

D. 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.

2.4 OPERATION MANUALS

A. 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.

B. 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.

C. 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.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. 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.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. 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 warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
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.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. 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 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. 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.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

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

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. 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. Do not use original project record documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

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 administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints and annotated PDF electronic files of marked up record prints.

b. Final Submittal:

1) Submit three paper-copy set(s) of marked-up record prints and annotated PDF electronic files of marked up record prints.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and 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.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 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 archive 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 below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file, paper copy and scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. 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.

B. Format: Submit record Product Data as annotated PDF electronic file, paper copy, and scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file, paper copy, and scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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. Maintenance of Record Documents and Samples: Store record documents and Samples 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.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

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 administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 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. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. 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.

PART 3 - EXECUTION

3.1 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.

3.2 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. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete Subcontractor.
    e. Special concrete finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures 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. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

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.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

E. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
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 mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that 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.

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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Wire: ASTM A 1064, galvanized.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," 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 steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
2. Fly Ash: ASTM C 618, Class C or F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) for footings and piers, 3/4 inch (19 mm) for slabs, nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330/C 330M, 1-inch (25-mm) nominal maximum aggregate size.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Water: ASTM C 94/C 94M and potable.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
1. Available Products:
    a. Axim Concrete Technologies; Fibrasol IIP
    b. Euclid Chemical Company (The); Fiberstrand 100.
    c. FORTA Corporation; Forta Mono.
    d. Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
    e. Metalcrete Industries; Polystrand 1000.
    f. SI Concrete Systems; Fibermix Stealth.

B. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
1. Available Products:
    a. Axim Concrete Technologies; Fibrasol F.
    b. Euclid Chemical Company (The); Fiberstrand F.
    c. FORTA Corporation; Forta.

d. Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
e. SI Concrete Systems; Fibermesh.

2.7 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513 for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Available Manufacturers:

a. Greenstreak.
b. Progress Unlimited, Inc.
c. Williams Products, Inc.

2. Profile: Flat dumbbell with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products:

a. Fortifiber Corporation; Moistop Ultra, 10 mils, min.
b. Raven Industries Inc.; Vapor Block 10.
c. Stego Industries, LLC; Stego Wrap, 15 mils.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Available Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.

k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when 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, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. Burke by Edoco; Spartan Cote WB II.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
f. Euclid Chemical Company (The); Aqua Cure VOX.
g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
h. Lambert Corporation; Glazecote Sealer-20.
i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure.
l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
n. Tamms Industries, Inc.; Clearseal WB 150.
o. Unitex; Hydro Seal.
p. US Mix Products Company; US Spec Hydrasheen 15 percent Vexcon Chemicals, Inc.; Starseal 309.Verify with manufacturer that retained products have been tested against interference with bonding of floor covering.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, 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 (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, 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 (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete. Freezing and thawing Class F0, Sulfate Class S1, Permeability Class P0, Corrosion protection of reinforcing Class C1.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Minimum cement content 5.0 bags per cubic yard.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

B. Foundation Walls: Normal-weight concrete. Freezing and thawing Class F1, Sulfate Class S1, Permeability Class P0, Corrosion protection of reinforcing Class C0.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum cement content 6.0 bags per cubic yard.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete. Freezing and thawing Class F0, Sulfate Class S0, Permeability Class P0, Corrosion protection of reinforcing Class C0.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 6.0 bags per cubic yard.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

4. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd. (0.90 kg/cu. M).

D. Formed Concrete and Concrete Toppings: Normal-weight or semi (sand) lightweight concrete, as indicated. Freezing and thawing Class F0, Sulfate Class S0, Permeability Class P0, Corrosion protection of reinforcing Class C0.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Minimum Cementitious Materials Content: 6.0 bags per cubic yard.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery.
5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.
6. Welded Wire Reinforcement: As indicated on drawings.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, 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 INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until 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 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct 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.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. 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. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

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 rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive 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. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved **at least 75 percent of** its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 that reduce bond to concrete.

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. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement 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.

3.7 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. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete. Remove metal keyway 24 hours after first concrete placement and prior to second concrete placement.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Cut 50% of welded wire crossing contraction joints in slabs on grade.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is 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 indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) 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 mixture constituents to segregate.

E. 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, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view at completion of construction.

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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

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.

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.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten

until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
3. In addition to ASTM E 1155 (ASTM E 1155M) testing of floor flatness and levelness, finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 4 inches ((100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
4. 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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) 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 (1 kg/sq. m 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 for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, 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 (300-mm) 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 (300 mm), 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 certifies does not interfere with bonding of floor covering used on Project.

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.

   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.13 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 two month(s). 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 joints clean and dry.

3.14 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 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) 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 to solid concrete. Limit cut depth to 3/4 inch (19 mm). 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 matches 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 (0.25 mm) 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 (6 mm) 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 (25 mm) 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 a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture 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 (25 mm) 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.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections: (Section 01 40 01 shall govern in any conflicts)

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, 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 mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567/C 567M, 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 mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. 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.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. 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 mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. 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.
12. 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/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION 033000

SECTION 048000 - MASONRY

PART 1 - GENERAL

1.01 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strength of masonry of (f'M) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Table 1 and Table 2 in ACI 530.1/ASCE 6/TMS 602.

B. Concrete Masonry Units: f'_M = 2,000 psi

C. Clay Masonry Units: f'_M = 2,000 psi

1.02 HANDLING AND STORAGE

A. Handle brick and concrete masonry units to prevent chipping and breakage, and store on platforms to protect them from contact with the soil. Cover stored brick and block with waterproof coverings.

B. Deliver, store and handle mortar materials to prevent deterioration, inclusion of foreign materials, damage of materials by water or breakage. Packages or materials showing evidence of water or damage shall be rejected.

C. Any material damaged in any way shall not be used for masonry work. Cement and lime shall be delivered and stored in the original, unbroken containers, marked as to manufacturer and brand.

1.03 QUALITY ASSURANCE

A. Fire Performance Characteristics: Where indicated on the drawings, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119-88 by a recognized testing and inspecting organization.

B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product specified herein for each continuous surface or visually related surfaces.

C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

D. Field Constructed Mock-Ups: Prior to installation of masonry work, erect sample wall panels in a location approved by the Architect to represent completed masonry work for qualities of appearance, materials and construction; build mock-ups to comply with the following requirements:

1. Build mock-ups for exterior wall 6' long by 4' high by full thickness, including face and back-up wythes as well as accessories.
2. Retain mock-ups during construction as standard for judging completed masonry work. When directed by the Architect, demolish mock-ups and remove from site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete Masonry Units: Conform to ASTM C90-85, Type N-II. Hollow lightweight, concrete masonry units of modular dimensions of size and shapes

necessary to complete the work. Units shall be sound and free from cracks, chipped edges, and defects which would interfere with their setting or impair the strength or durability of the construction. Exposed Faces: Manufacturer's standard color and texture.

B. Water: Clean and potable.

C. Portland Cement: Conform to ASTM C1329/C 1329M. Cement used throughout the project shall not vary in color.

D. Masonry Cement: Conforms to ASTM C91-89, Type M, S or N.

E. Sand for Masonry Work: Conform to ASTM C144-87, of color matching approved sample.

F. Joint Reinforcement: Have 8-gauge side bars conforming to ASTM A82-88 and 9 gauge cross bars, formed to truss design, with side bars and cross bars galvanized. Reinforcement shall be of width to extend to within 1" of the faces of the walls equal to Dur-O-Eye with 3/16" diameter Dur-O-Wall adjustable wall tie eye sections welded at 16" centers.

G. Wire Mesh Ties: Galvanized hardware cloth, 19 gauge, 1/2" mesh, 3" minimum width.

H. Concealed Flashing Materials:

1. Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of 3 oz. sheet copper coated with flexible fibrated asphalt.
2. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated on the drawings.

I. Miscellaneous Masonry Accessories:

1. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated on the drawings. Styrene-butadiene rubber compound.
2. Weepholes: Provide the following for weepholes:
   a Mortar net weep vents.
3. Flexible, Self-Sealing Wall Flashing: Self-sealing, self-healing, fully adhering, composite flexible flashing consisting of 32 mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8 mil thick, high-density, four plies of cross-laminated polyethylene film to produce an overall 40 mil thickness in rolls 75 feet long; protected from contamination from dust or dirt by a silicone-coated release sheet, to be removed immediately before installation.

J. Masonry Grout: Use grout conforming to ASTM C476 and the Structural Notes on sheet S1.0 of the structural drawings.

A. Vertical reinforcement: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners

1. Horizontal Bars: Dur-O-Wal D/A 811; nine-gauge basic bright finish steel wire meeting ASTM A82-01.
2. Vertical Bars: Dur-O-Wal D/A 810; nine-gauge basic bright finish steel wire meeting ASTM A82-01.

1.02 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or admixtures, unless otherwise indicated on the drawings. Do not use calcium chloride in mortar or grout.

B. Mortar Color: Neutral.
C. Mixing: combine and mix cementitious, water and aggregates in mechanical batch mixer; comply with referenced ASTM standards for mixing times and water content.
D. Mortar for Unit Masonry: Comply with ASTM C 270-88a, Proportion Specification, for types of mortar specified, unless otherwise indicated on the drawings.
   1. Use Type M mortar for masonry below grade and in contact with earth, and where indicated on the drawings.
   2. Use Type M or S mortar for load bearing exterior and interior load bearing walls.
   3. Use Type N mortar for interior non-load bearing walls and other applications where another type is not indicated on the drawings.
E. Grout for Unit Masonry: Use concrete grout as indicated on structural drawings.
   1. The quantities of cementitious materials shall be adjusted to maintain the specified strength.

1.03 MIXING MORTARS

A. Mortars shall be machine mixed in mixer in which water quantity can be controlled. For work requiring only small mortar or grout batches, mortar may be hand mixed.
B. Mixing time shall be at least 5 minutes, 2 minutes which shall be devoted to mixing dry materials and 3 minutes for continuing mixing after addition of water. Use no mortars that have stood more than one and one-half hours.
C. Where dry mix method is used, rake wall; turn over materials for each batch before adding water until even color of mixed materials indicates that cementitious material has been distributed throughout mass, after which add water in increments until mixed mortar of workable plasticity is obtained.
D. Pointing mortar shall be of dry consistency as will produce mortar sufficiently plastic to be worked into masonry joints.

PART 2 - EXECUTION

2.01 WORKMANSHIP

A. Work of other trades shall be installed and tested before enclosing such work with masonry.
B. Build-in horizontal masonry reinforcement at 8" on center vertically below grade and 16" on center vertically above grade. Joint reinforcement shall be continuous, lapped not less than 6" at splices, with corners cut and bent to ensure continuity. Joint reinforcement shall not pass through vertical control joints. At corners where joint reinforcement does not occur in the same course in two abutting walls, carry joint reinforcement from each wall around the corner not less than three feet into abutting wall.
C. Examine drawings to determine requirements for accommodation of work of other trades and provide recesses, chases, reglets, slots for such work; patch around same.
D. In cold weather, when the outside temperature is below 40□F, the temperature of the masonry when laid shall be above 40□F and maintained on both sides of the masonry wall for at least 72 hours.
E. Make provisions to prevent damage from wind.
F. Keep masonry dry until capped by construction details. Cover tops of all walls and other masonry when stopping work for the day and protect them at all times from

rain with weighted canvas of 6 mil polyethylene film covers.

G. Provide cutting and patching to accomplish the indicated work and to accommodate the work for others. Patching shall match adjoining work in pattern and texture. Masonry saws shall be used for cutting masonry units.

2.02 BLOCK MASONRY

A. Concrete masonry units shall be of sizes shown on the drawings, laid up plumb and true to line, and with cells vertical. Interior exposed concrete masonry units shall be laid up in running bond.

B. The first course of block shall be laid on a full bed of mortar after the concrete slab has been cleaned and dampened. Except at cells containing reinforcing rods, fill cells of the first course solid with mortar.

C. Work shall be anchored and bonded as specified above.

D. The vertical mortar joint at wall intersections shall be raked out to a depth of 1" on both faces, caulked per Section 079200 - Caulking.

E. Voids in concrete masonry units containing reinforcing rods, and at locations shown on the drawings, shall be filled with 3,000 psi grout as indicated on structural drawings.

F. One block and one joint shall equal 8".

G. Joints shall be of uniform thickness, and where exposed shall be concave.

H. Build rated walls per UL U905.

2.03 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls and arrises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

2.04 LAYING MASONRY WALLS

A. Layout walls in advance for specified spacing of surface bond patterns with uniform joint widths and to locate openings, movement-type joints, returns and offsets. Do not use less-than-half-size units at corners, jambs and wherever possible at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses spaced and coordinated with other work.

C. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not

tooth. Clean exposed surfaces of set masonry, wet units lightly and remove loose masonry units and mortar prior to laying fresh masonry.

D. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in with masonry around built-in items.
   1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
   2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
   3. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated on the drawings.

2.05 MORTAR BEDDING AND JOINTING

A. 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 in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Maintain joint widths shown, except for minor variations to maintain bond alignment. If not shown, lay walls with 3/8" joints.

C. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.

D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. For adjustments, remove units, clean off mortar and reset in fresh mortar.

2.06 VERTICAL REINFORCING

A. All vertical reinforcing shall be installed at the centerline of the wall (or at the locations indicated) with a tolerance of plus or minus 1/2-inch lateral to the wall centerline.

B. **Reinforcing Bar positioners shall be used for all vertical reinforcing**.
   1. Provide two per 5-foot lift but not less than two per each length of spiced reinforcing bar.
   2. Horizontal Type: Install in accordance with ACI Committee 530 Code Recommendations.
   3. Vertical Type: Install in U-block or lintel block in accordance with Code requirements.

2.07 GROUTING

A. All grouting of masonry shall be installed in five-foot lifts with each lift being grouted before laying masonry units for next lift.

B. Grouted masonry shall be constructed in such a manner that all elements of the masonry act together as a structural element.

C. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than ½ inch, mortar droppings or other foreign material. Grout shall be placed so that all spaces designated to be grouted shall be filled with grout and the grout shall be confined to those specific spaces.

D. Grout materials and water content shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly.
E. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.
F. Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of 1½ inches below a mortar joint, except at top of wall. Where bond beams occur, stop grout pour a minimum of ½ inch below the top of the masonry.
G. All cells and spaces containing reinforcing bars shall be filled with grout. Otherwise, grout masonry indicated on drawings.

2.08 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY
A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown on the drawings, but not less than one metal tie for 4 sq. ft of wall area spaced not to exceed 24" o.c. horizontally and vertically. Stagger ties in alternate courses. Provide additional ties with 1'-0" of all openings. At intersecting and abutting walls, provide ties at no more than 24" o.c. vertically.
B. Corners: Provide interlocking masonry unit bond in each course at corner of split-face units. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

2.09 CAVITY WALLS
A. Keep cavity clean of mortar droppings and materials during construction. Strike joints facing cavity flush.
B. Provide weep holes in exterior wythe of cavity wall located immediately above ledges and flashing, spaced 2'-0" o.c. unless otherwise indicated on the drawings. Weep holes shall also be located in the first course of masonry above finish grade.

2.10 HORIZONTAL JOINT REINFORCEMENT
A. General: Provide continuous horizontal joint reinforcement in alternate courses of each wythe of all concrete masonry, including 4" veneer. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".
B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated on drawings.
C. Reinforce each wythe of all walls with continuous horizontal joint reinforcing unless noted to be omitted on drawings.
D. Provide continuity at corners by use of prefabricated "L" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions. Space continuous horizontal reinforcement.
E. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints 8" apart, above the lintel and below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. In load bearing wall, provide additional reinforcing as indicated on the structural drawings.

2.11 ANCHORING MASONRY WORK
A. General: Provide anchor devices of type indicated on the drawings.

B. Anchor masonry to structural members where masonry abuts or faces structural members as indicated on structural drawings.

2.12 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry at 20'-0" on center max, or where shown on the drawings. Build-in related items as the masonry work progresses.

B. Build-in non-metallic joint fillers where indicated on the drawings.

2.13 LINTELS

A. Install steel and masonry lintels where indicated and as scheduled on the drawings.

B. Provide masonry lintels where shown the drawings, and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide formed-in-place masonry lintels. Support formed-in-place lintels. For hollow concrete masonry unit walls, use formed U-shaped lintel units with reinforcement bars placed as shown on the drawings, filled with coarse grout.

C. Provide minimum bearing of 8" at each jamb, unless otherwise indicated on drawings.

2.14 FLASHING OF MASONRY WORK

A. General: Provide concealed flashing in masonry work at, or above, 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 sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.

B. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Form "end-dam" at end of flashing to stop lateral flow of water. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall in exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing through the inner wythe and turn up 2". At heads and sills turn up ends not less than 2" to form a pan.

C. Provide weep holes in the head joints of the first course of masonry immediately above concealed flashings. Space 24" o.c. unless otherwise indicated on the drawings.

D. Install reglets and nailers for flashing and related work where shown on the drawings to be built into masonry.

2.15 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. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is set and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-

metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean standard concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

D. Protection: Provide final protection and maintain conditions in the manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of Final Certificate of the Architect.

END OF SECTION 048000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Field-installed shear connectors.
   3. Grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
   5. Identify members and connections of the Seismic-Load-Resisting System.
   6. Indicate locations and dimensions of protected zones.

7. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Surveys:
1. Submit survey indicating elevations and locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates and other embedments to receive structural framing. Indicate discrepancies between actual installation and contract documents.
2. Submit survey indicating final elevations and locations of columns and other major structural steel elements. Steel survey shall include column plumbness after structural steel erection. Indicate discrepancies between actual installation and the contract documents. Have surveyor that performed surveys certify their accuracy.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or a fabricator that produces a minimum annual average of 500 tons of fabricated structural steel, with not less than ten (10) years experience fabricating buildings of equal or larger size and complexity and be subject to shop inspection by qualified special inspector.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE or an installer with not less than ten (10) years experience constructing buildings of equal or larger size and complexity.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using High Strength Bolts”.

1.8 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 Architect'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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use Allowable Stress Design; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Ordinary Moment frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A1085/A 500, Grade C, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

1. Weight Class: As indicated.
2. Finish: Black except where indicated to be galvanized.

F. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

G. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain.

G. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

H. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

I. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. 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/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."

F. 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.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate 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.

2.7 SHOP CONNECTIONS

1. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts".

B. for type of bolt and type of joint specified.

1. Joint Type: Snug tightened or Slip critical; As indicated.

C. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 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 (50 mm). Steel embedded in concrete or mortar shall receive two coats of bitumastic paint.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

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 3, "Power 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 minimum dry film thickness of 1.5 mils (0.038 mm). 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 surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.9 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 are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize exterior steel, lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop and field inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using High Strength Bolts”.

B. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M. For welds not produced in a single pass, visually inspect and evaluate using the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

C. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and 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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection begins, survey elevations and plan locations of concrete- and masonry- bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and specified tolerances.

1. Engage land surveyor to perform surveying

2. Survey submittals shall indicate elevations and plan locations and discrepancies between actual installation and Contract Documents

3. Connections to surveyed items cannot be made until submittal has been approved by Architect and unsatisfactory conditions have been corrected.

B. As erection proceeds, survey final elevations and plan locations of columns, beams, and other major structural steel elements for compliance with requirements and specified tolerances.

1. Engage land surveyor to perform surveying

2. Steel frame survey submittals shall indicate final elevations and plan locations of columns, beams, and other major framing, as well as column plumbness. Indicate discrepancies between actual installation and the Contract Documents.

3. Placement or application of other materials which might obscure or restrain surveyed elements cannot be made until submittal has been approved by the Architect and unsatisfactory conditions have been corrected.

C. Contractor shall check all architecturally exposed structural steel members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

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. Baseplates and Bearing 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 303, "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 are 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. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. 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

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.

2. Joint Type: Snug tightened and Slip critical; As indicated.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where exposed to view, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using High Strength Bolts". Test bolts in slip-critical joints.

C. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency'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 are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and 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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

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/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas 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.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Composite floor deck.
   2. Noncomposite form deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

   1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. 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.

2.2 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [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]:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite

Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Profile Depth: 1-1/2 inches (38 mm), 3 inches (76 mm) or As indicated.
3. Design Uncoated-Steel Thickness: 0.0358 inch (0.91 mm), minimum or As indicated.
4. Span Condition: Single, Double or Triple span.

2.3 NONCOMPOSITE FORM DECK

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. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Group.
10. Roof Deck, Inc.
11. Valley Joist; Subsidiary of EBSCO Industries, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
14. <Insert manufacturer's name>.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), min, G60 (Z180) zinc coating.

2. Profile Depth: 15/16 inch (24 mm).
3. Design Uncoated-Steel Thickness: 0.0295 inch (0.75 mm).
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Space and locate welds as indicated.
3. Weld Washers: Install weld washers at each weld location as recommended by the Steel Deck Institute.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 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. Shelf angles.
   4. Loose bearing and leveling plates.
   5. Metal ladders.
   6. Metal bollards.

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.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 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. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.5 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. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.6 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 FERROUS 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.

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 (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); 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 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group [1 (A1)] [2 (A4)].

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. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

F. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

G. 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.

H. 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 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

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 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), 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 (1 mm), 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 (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) 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. Fabricate units from slotted channel framing where indicated.
2. 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. Galvanize miscellaneous framing and supports where indicated.

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 (200 mm), unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication at exterior applications.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 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. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.13 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails 18 inches (457 mm) apart, unless otherwise indicated.
4. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
2. Rungs: 3/4-inch- (19-mm-) 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 by coating with abrasive material metallically bonded to rung by a proprietary process.
5. Available Products:

a. IKG Industries, a Harsco company; Mebac.
b. W. S. Molnar Company; SlipNOT.

6. Galvanize exterior ladders, including brackets and fasteners.
7. Prime interior ladders, where indicated, including brackets and fasteners, with zinc-rich primer.

2.14 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate unless bollards are indicated to be concrete filled.

B. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4 inch (19 mm) steel machine bolt. See details on drawings for additional bollard attachment or embedment construction information.

2.15 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.

2.16 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) and Items Indicated to Receive Zinc-Rich Primer: 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.

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.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

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 grout, either metallic or nonmetallic, 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 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction in accordance with details and requirements provided.

B. Anchor internal sleeves for removable bollards in concrete by inserting into pipe sleeves preset into concrete or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of sleeve]. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward internal sleeve.

C. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

D. Place removable bollards over internal sleeves and secure with 3/4-inch (19-mm) machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

E. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055119 - METAL STAIRS, BALCONY, AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Industrial Class stairs with steel-grating treads.
2. Steel railings and guards attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.
4. Steel-grating at mezzanines.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Shop primer products.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

C. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

D. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

E. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

2.3 FASTENERS

A. Fasteners for Anchoring Railings and Guards Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type I-A, Level 1, and compatible with topcoat.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.

2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel channels.

    a. Stringer Size: As required to comply with "Performance Requirements" Article.
    b. Provide closures for exposed ends of channel stringers.
    c. Finish: Shop primed.

2. Construct platforms and tread supports of steel plate or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

    a. Provide closures for exposed ends of channel framing.
    b. Finish: Shop primed.

3. Weld stringers to headers; weld framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with 1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 15/16 inch (24 mm) o.c. and crossbars at 4 inches (100 mm) o.c.

2. Fabricate grating treads with steel angle or steel plate carrier at each end for stringer connections.

    a. Secure treads to stringers by welding..

3. Fabricate grating platforms with nosing matching that on grating treads.

    a. Secure grating to platform framing by welding.

D. Risers: Open.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-5/8-inch- (41-mm-) diameter top and bottom rails and square posts.
2. Intermediate Rails Infill: 1-5/8-inch- (41-mm-) diameter intermediate rails spaced less than 21 inches (533 mm) clear.

C. Welded Connections: Fabricate railings and guards with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

    a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.
4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.
6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #3 - Partially dressed weld with spatter removed as shown in NAAMM AMP 521.

D. Form changes in direction of railings and guards as follows:

1. As detailed.

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.

1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing and guard members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

3. Provide type of bracket that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.8 FINISHES

A. Finish metal stairs and grating after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.2 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
4. Secure posts, rail ends, and guard ends to building construction as follows:

    a. Anchor posts to steel by welding to steel supporting members.
    b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

3.3 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting". Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055119

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Plywood backing panels.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, , fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

2.6 METAL FRAMING ANCHORS

A. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.7 MISCELLANEOUS MATERIALS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

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

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

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

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Manufacturer of products Licensed participant in AWI's Quality Certification Program.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. Architectural Woodwork Standards Grade: Premium.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.
   1. Reveal Dimension: 1/2 inch (13 mm).

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

   1. Formica Corporation
   2. Pionite; a Panolam Industries International, Inc. brand
   3. Wilsonart LLC

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade HGS.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated by laminate manufacturer's designations.
   2. Match Architect's sample.
   3. As selected by Architect from laminate manufacturer's full range in the following categories:

      a. Solid colors, matte finish.
      b. Solid colors with core same color as surface, matte finish.
      c. Wood grains, matte finish.
      d. Patterns, matte finish.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
   1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
   2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening**,** self-closing.

D. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid metal**,** 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

F. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

G. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

H. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

I. Drawer Slides: ANSI/BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
      a. Type: Full extension.
      b. Material: Zinc-plated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2.
   4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
   5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
   6. For computer keyboard shelves, provide Grade 1.
   7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-100.

J. Door Locks: ANSI/BHMA A156.11, E07121.

K. Drawer Locks: ANSI/BHMA A156.11, E07041.

L. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

M. Grommets for Cable Passage: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Color: Black.

N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
   1. Satin Stainless Steel: ANSI/BHMA 630.

O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.4 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
   1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 064116

SECTION 071900 – VAPOR BARRIERS

PART 1 - GENERAL

1.01 GENERAL

A. Provide vapor barrier under all concrete slabs-on-grade.

PART 2 - PRODUCTS

2.01 ELASTIC SHEET VAPOR BARRIERS

A. Polyethylene Vapor Barrier: 6-mil carbonated polyethylene film, rated 0.1 perms or less.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide lapped seams and lap vapor barriers onto other work at edges of coverages and at penetrations of barriers by other work. Seal lapped seams and laps onto other work with adhesive or self-adhesive tape of type recommended by vapor barrier manufacturer. Before covering over vapor barriers with other (concealing) work, patch punctures and tears with adhesive type barrier material or tape with perm rating equal to barrier rating.

END OF SECTION 071900

SECTION 072179 - ACOUSTICAL SPRAY-ON SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Sprayed cellulose acoustical insulation.

1.02 RELATED ITEMS

A. Clips, hangers, supports, sleeves, and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.

B. Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.

C. Ceiling penetrations to be installed prior to application.

1.03 QUALITY ASSURANCE

A. Manufacturer must have a current Underwriters Laboratories (UL) Code Evaluation Report.

B. Manufacturer must be in compliance with the 2009 and 2012 International Building Code.

C. Manufacturer must be ISO 9001:2015 Certified.

D. Applicator: Licensed by manufacturer.

E. Manufacturer must subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories and Factory Manual. Each bag shall be accordingly.

F. Mock-up: Apply a 100 square foot representative sample to be reviewed by the Architect prior to proceeding.

1.04 SUBMITTALS

A. Submit product data that the product meets or exceeds the following specified requirements.

1. Bond strength shall be greater than 100 psf per ASTEM E 736
2. Product shall be Class 1 Class A per ASTM E 84/UL 723.
3. Non-corrosive per ASTM C 739.
4. Bond Deflection per ASTM E 759: 6” Deflection in 10’ Span – No Spalling or Delamination.
5. R-Valve to be 3.75 per inch per ASTM C 518.
6. Comply with 2009 IBC Section 803.10 stability requirements for interior finishes.
7. Meet ASTM C 1149.

B. Manufacturer’s written certification that product contains no asbestos, fiberglass, or other man-made mineral fibers.

C. Copy of manufacturer’s ISO 9001:2015 Certification.

D. Minimum Fiber Recycled Content to be 75%.

E. Cannot contain any added Urea-Formaldehyde Resins.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original, unopened containers bearing name of manufacturer, product identification, and reference to U.L. testing.

B. Store materials dry, off ground, and under cover.

C. Protect liquid adhesive from freezing.
E. Water to be potable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. International Cellulose Corporation
12315 Robin Blvd.
Houston, TX 77045
(713) 433-6701 or (800) 444-1252
FAX: (713) 433-2029
www.spray-on.com icc@spray-on.com
B. For approved applicators contact ICC or 800-444-1252.

2.02 MATERIALS
A. K-13 Spray-On-Systems.
1. Color shall be from Manufacturer's standard color chart.
2. Comply with local Building Code requirements.
3. Material to have been tested in accordance with ASTM E 1042. Testing laboratory must be NVLAP accredited.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until satisfactory conditions are corrected.
B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or prevent discoloration caused by migratory stains.

3.02 PREPARATION
A. Provide masking, drop cloths, or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
C. Prime surfaces as required by manufacturer's instructions or as determined by examination.

3.03 INSTALLATION
A. Install spray applied insulation according to manufacturer's recommendations.
B. Install spray applied insulation to achieve an average NRC of 0.80 (1" thick)
C. Cure insulation with continuous natural or mechanical ventilation.
D. Remove and dispose of over-spray.

3.04 PROTECTION
A. Protect finished installation under provision of Division 1.

END

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanically fastened, thermoplastic polyolefin (TPO) roofing system.
   2. Substrate board.
   3. Roof insulation.
   4. Cover board.

B. Alternate Bid:
   1. Note that this roofing is for the enclosed corridor being bid as an additive alternate.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

   1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

      a. Submit evidence of compliance with performance requirements.

   2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Sample warranties.

1.5 WARRANTY

   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

D. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fabric-backed TPO sheet.
   1. Thickness: 60 mils (2.0 mm), nominal.
   2. Exposed Face Color: White.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard.

E. Slip Sheet: Manufacturer's standard, of thickness required for application.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, felt or glass-fiber mat facer on both major surfaces.
   1. Thickness:
      a. Base Layer: 1-1/2 inches (38 mm).
      b. Upper Layer: To provide total R-25 minimum.

B. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

B. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
   1. Thickness: 1/4 inch (6 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.3 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.

    a. Locate end joints over crests of decking.
    b. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

        1) Trim insulation so that water flow is unrestricted.

    c. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
    d. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
        1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
    e. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
    f. Install tapered insulation under area of roofing to conform to slopes indicated.
    g. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    h. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
    i. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

        1) Trim insulation so that water flow is unrestricted.

    j. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
    k. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
    l. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

3.4 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

3.5 INSTALLATION OF MECHANICALLY FASTENED ROOF MEMBRANE

A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.

H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.6 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 INSTALLATION OF WALKWAYS

A. Flexible Walkways:

1. Install flexible walkways at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   d. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch (76-mm) clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 075423

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.
3. Reglets and counterflashings.

B. All work in this Section shall match the existing building being added to as to material, color, size, and shape.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Product Test Reports: For tests performed by a qualified testing agency.

E. Sample warranty as required in Section 075216 “SBS Modified Bituminous Membrane Roofing”.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are and SPRI ES-1 tested to specified design pressure.

1.4 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075216 "SBS Modified Bituminous Membrane Roofing".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As required by building code.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Formed Aluminum Sheet Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.

a. Surface: Smooth, flat finish.
b. Finish: Clear anodic.

2. Corners: Factory mitered and soldered or continuously welded.
3. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
b. Face-Leg Cleats: Concealed, continuous stainless steel.

2.3 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Formed Aluminum: 0.050 inch (1.27 mm) thick.
2. Corners: Factory mitered and soldered or continuously welded.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum: 0.032 inch (0.81 mm) thick.

C. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

D. Aluminum Finish: Anodized, match existing.

2.4 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F (29 deg C).

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

B. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.7 FINISHES

A. Coil-Coated Aluminum Sheet Finishes:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings, roof-edge specialties, and reglets, and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.

2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer’s required spacing that meets performance requirements.
2. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

A. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

B. Shop Drawings: For roof accessories.

PART 2 - PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.

D. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Fabricate curbs to minimum height of 8 inches above roofing surface unless otherwise indicated.
3. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
4. Liner: Same material as curb, of manufacturer's standard thickness and finish.
5. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
6. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.

7. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
8. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.2 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation and mill phosphatized for field painting where indicated.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

G. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

D. Product test reports.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

PART 2 - PRODUCTS

2.01 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:
   1. A/D Fire Protection Systems Inc.
   2. Grace Construction Products.
   3. Hilti, Inc.
   4. Johns Manville.
   5. Nelson Firestop Products.
   6. NUCO Inc.
   7. Passive Fire Protection Partners.
   8. RectorSeal Corporation.

9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

D. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.02 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.03 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.04 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

D. See “Pentration Firestopping Schedule” attached for applicable systems.

PENETRATION FIRESTOPPING SCHEDULE
FIRESTOPPING SYSTEMS ARE LISTED USING THE ALPHA-ALPHA-NUMERIC IDENTIFICATION SYSTEM PUBLISHED IN
UL'S *FIRE RESISTANCE DIRECTORY*, VOLS. 2A - 2B

TYPE OF PENETRANT	CONSTRUCTION							
	FLOOR PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR F)				WALL PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR W)			
	CONCRETE FLOORS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 5 INCHES (127 MM)	CONCRETE FLOORS WITH A MINIMUM THICKNESS OF MORE THAN 5 INCHES (127 MM)	FRAMED FLOORS	FLOOR-CEILING ASSEMBLIES CONSISTING OF CONCRETE WITH MEMBRANE PROTECTION	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 8 INCHES (203 MM)	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS OF MORE THAN 8 INCHES (203 MM)	FRAMED WALLS	COMPOSITE PANEL WALLS
NO PENETRATING ITEMS	C-AJ-0001-0999 or F-A-0001-0999	C-BJ-0001-0999 or F-B-0001-0999	F-C-1001-1999		C-AJ-0001-0999, C-BJ-0001-0999, or W-J-0001-0999		W-L-000-1-0999	
METALLIC PIPE, CONDUIT, OR TUBING	C-AJ-1001-1999 or F-A-1001-1999	C-BJ-1001-1999, C-BK-1001-1999, or F-B-1001-1999	F-C-1001-1999	F-E-1001-1999	C-AJ-1001-1999, C-BJ-1001-1999, or W-J-1001-1999	C-BK-1001-1999 or W-K-1001-1999	W-L-1001-1999	W-N-1001-1999
NONMETALLIC PIPE, CONDUIT, OR TUBING	C-AJ-2001-2999 or F-A-2001-2999	C-BJ-2001-2999, C-BK-2001-2999, or F-B-2001-2999	F-C-2001-2999	F-E-2001-2999	C-AJ-2001-2999, C-BJ-2001-2999, or W-J-2001-	C-BK-2001-2999 or W-K-2001-2999	W-L-2001-2999	W-N-2001-2999

					2999			
ELECTRICAL CABLES	C-AJ-3001-3999 or F-A-3001-3999	C-BJ-3001-3999, C-BK-3001-3999, or F-B-3001-3999	F-C-3001-3999	F-E-3001-3999	C-AJ-3001-3999, C-BJ-3001-3999, or W-J-3001-3999	C-BK-3001-3999 or WK-3001-3999	W-L-3001-3999	
CABLE TRAYS WITH ELECTRICAL CABLES	C-AJ-4001-4999 or F-A-4001-4999	C-BJ-4001-4999 or F-B-4001-4999			C-AJ-4001-4999, C-BJ-4001-4999, or W-J-4001-4999	W-K-4001-4999	W-L-4001-4999	
INSULATED PIPES	C-AJ-5001-5999 or F-A-5001-5999	C-BJ-5001-5999, C-BK-5001-5999, or F-B-5001-5999	F-C-5001-5999	F-E-5001-5999	C-AJ-5001-5999, C-BJ-5001-5999, or W-J-5001-5999	C-BK-5001-5999	W-L-5001-5999	W-N-5001-5999
MISCELLANEOUS ELECTRICAL PENETRANTS	C-AJ-6001-6999 or F-A-6001-6999	C-BJ-6001-6999			C-AJ-6001-6999, C-BJ-6001-6999, or W-BJ-6001-6999		W-L-6001-6999	
MISCELLANEOUS MECHANICAL PENETRANTS	C-AJ-7001-7999 or F-A-7001-7999	C-BJ-7001-7999 or F-B-7001-7999	F-C-7001-7999	F-E-7001-7999	C-AJ-7001-7999, C-BJ-7001-7999, or W-J-7001-7999		W-L-7001-7999	W-N-7001-7999

PENETRATION FIRESTOPPING SCHEDULE FIRESTOPPING SYSTEMS ARE LISTED USING THE ALPHA-ALPHA-NUMERIC IDENTIFICATION SYSTEM PUBLISHED IN UL'S *FIRE RESISTANCE DIRECTORY*, VOLS. 2A - 2B

TYPE OF PENETRANT	CONSTRUCTION						
	FLOOR PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR F)				WALL PENETRATION SYSTEMS (FIRST ALPHA COMPONENT = C OR W)		
	CONCRETE FLOORS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 5 INCHES (127 MM)	CONCRETE FLOORS WITH A MINIMUM THICKNESS OF MORE THAN 5 INCHES (127 MM)	FRAMED FLOORS	FLOOR-CEILING ASSEMBLIES CONSISTING OF CONCRETE WITH MEMBRANE PROTECTION	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS LESS THAN OR EQUAL TO 8 INCHES (203 MM)	CONCRETE OR MASONRY WALLS WITH A MINIMUM THICKNESS OF MORE THAN 8 INCHES (203 MM)	FRAMED WALLS
GROUPINGS OF PENETRATIONS	C-AJ-8001-8999 or F-A-8001-8999	C-BJ-8001-8999 or F-B-8001-8999	F-C-8001-8999	F-E-8001-8999	C-AJ-8001-8999, C-BJ-8001-8999, or W-J-8001-8999		W-L-8001-8999

Remarks: For each location where a fire-resistance-rated floor or wall assembly is penetrated, provide a UL-listed penetration firestopping system selected from the applicable UL number range listed above that complies with Division 07 Section "Penetration Firestopping" and that is suitable for the penetration conditions indicated for the Project.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urethane joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.
4. Security caulking.

1.2 PREINSTALLATION MEETINGS

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

1.4 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

A. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.

1. Tremco Incorporated

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Dow Corning Corporation
2. GE Construction Sealants: Momentive Performance Materials Inc.
3. Pecora Corporation
4. Tremco Corporation

2.4 SECURITY CAULKING

A. Security caulking with a shore hardness of 70 or greater.

1. Pecora Dynapoxy EP 1200
2. Superior Epoxies & Coatings SPS

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 JOINT-SEALANT SCHEDULE

A. Security Caulking Application
1. All joints at all inmate Dayrooms, cells, toilets, and showers shall have security caulking.
2. Caulking Color: concrete gray.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. .
d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 078200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) 1991, and as herein specified.

B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated on drawings, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152-81a "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with these specifications.

B. Shop Drawings: 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 finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work; otherwise, remove and replace damaged items as directed.

B. Store doors and frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569-72(1979) and ASTM A 568-84.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366-72(1979) and ASTM A 568-84.

C. Steel for doors and frames at exterior openings and shower rooms shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized.

D. Supports and Anchors: Fabricate of galvanized sheet stock of same gauge thickness as face-sheets of doors but under no circumstances less than 16 gauge.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153-82, Class C or D as applicable.

F. Shop Applied Paint:
   1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.02 FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Identify work that cannot be factory-assembled before shipment, to assure assembly at project site. Comply with SDI-100 as follows:
   1. Interior Doors: SDI-100, Grade II, heavy-duty, Model 1, minimum 16-gauge faces. Core Construction - **Vertical Steel Stiffeners**
   2. Exterior Doors: SDI-100, Grade III, extra heavy-duty, Model 2, minimum 16-gauge faces. Core Construction – **Vertical Steel Stiffeners**

B. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Torx heads for exposed screws and bolts.

C. Thermal-Rated (Insulating) Assemblies: At exterior locations, provide doors which have been fabricated as thermal insulating door and frame assemblies and tested in Accordance with ASTM C 236. Provide thermal-rated assemblies with U factor of 0.24 Btu/(hr x ft2 x EF) or better.

D. Finish Hardware Preparation: 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 ANSI A115 series specifications for door and frame preparation for hardware.

E. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

F. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

G. 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 finished surface ready to receive finish paint.

H. Door Louvers: Provide sightproof stationary louvers for interior doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24-gauge cold-rolled steel set into 20-gauge steel frame.

2.03 STANDARD STEEL FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, window base frames, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated on drawings. Fabricate frames of minimum 16-gauge cold-rolled furniture steel. Fabricate frames with mitered and welded corners for installation in masonry.

B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames. Provide Silencers.

C. Plaster Guards: Provide 26-gauge steel pilaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames".

1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames in position, plumbed, aligned, and braced until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
4. Install fire-rated frames in accordance with NFPA Std. No. 80.
5. Door Installation:
   - a Fit hollow metal doors in frames, within clearances specified in SDI-100.
   - b Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
   - c Door shims are to be metal and NO SHIMS are to exceed one half the hinge thickness. Installation and adjustment to be per SDI-122.

3.02 APPLICATION OF FINISH HARDWARE

A. Receive, store and be responsible for all finished hardware. Tag, index and file all keys. Use care not to injure work when applying hardware. Remove and replace doors so bottoms may be painted.

B. The location of hardware shall be as follows unless otherwise shown on drawings: Locate door knobs to center strikes 40-5/16" above finished floor; center door pulls 42" and push plates 48" above finished floor; center cylinder deadlocks 60" above finished floors except where push and pull plates are cut to accommodate cylinders; center single push bars 45" above finished floor; locate centerline of top hinge 9-3/4" below head of frame; locate centerline of bottom hinge 10-3/8" above finished floor; space center hinges equal distance between top and bottom hinges. Center panic devices 38" above finished floor.

C. Remove escutcheons, cover door knobs and pulls with heavy cloth until painting is completed. Prior to completion of building, examine doors; adjust and leave hardware in working order.

3.03 ADJUST AND CLEAN

A. Prime Coat Touch-Up: 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 081113

SECTION 081123 - SECURITY HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL

A. The products specified in this section shall be coordinated with Section 087163, SECURITY HARDWARE and Section 088853, SECURITY GLASS AND GLAZING. All security doors and frames shall be fabricated by the same manufacturer.

B. This section includes requirements for security hollow metal doors, door frames, side lights, borrowed lights, window walls, and related items of work necessary for a complete facility in accordance with the contract documents. It includes furnishing and installation of security hollow metal doors and frames of all types indicated as "SHM" or with hardware designations of "SH". Furnishing only, and timely delivery to the location designated, all embedded anchor bars and other shapes as indicated on plans and called for in this section as required to firmly anchor all devices and miscellaneous security framing to concrete or masonry work. Work of this section does not include security hollow metal doors and frames which are cast in place in precast concrete modules. Work of this section does include sliding device doors("case opening" three sided frames at these locations are by precast modular manufacturer) located in dayrooms 355 and 398 and plumbing chase doors and door frames located in plumbing chases between 4-man precast modular cell units.

1.02 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

American Society of Testing Materials (ASTM):

A 366-72 Steel, Carbon, Cold-Rolled Sheet, Commercial Quality (R 1979)

A 526-80 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip process, Commercial Quality

A 569-72 Steel, Carbon (0.15 maximum, percent), Hot-Rolled(R 1979)Sheet and Strip, Commercial Quality

B-117073 Methods of Salt Spray Fog Testing (R 1979)

D-1735 Water Fog Test for Organic Coatings

G 60-79 Conducting Cyclic Humidity Tests

B. National Association of Architectural Metal Manufacturers (NAAMM):

CHM-1-74 Recommended Architectural Specifications for Custom Hollow Metal Doors and Frames

C. HMMA 863

1.03 ACCEPTABLE MANUFACTURES

A. Work specified in this section shall be manufactured by one of the following:

1. Trussbilt, Inc.
2. American Steel
3. Habersham Metal Products
4. Claborn Manufacturing
5. Titan Steel Door

1.04 SUBMITTALS

A. Submit shop drawings before fabrication showing erection construction and requirements not fully described by manufacturer's data. Include plans and elevations at not less than 3/8" to 1'-0" scale and details at not less than 3" to 1'-0" scale. Indicate required anchorage and accessory items, field dimensions and finishes. Shop drawings for doors and frames shall come from the same manufacturer. Provide a schedule listing the location in the building of each door and frame using indicated reference numbers for details and openings shown in the contract documents.

B. Submit copies of manufacturers' material and fabrication specification and installation instructions modified to reflect project requirements and job conditions. Include instructions for handling, storage, and protection of each product.

1.05 DELIVERY AND STORAGE

A. Deliver security hollow metal doors, frames, and related items cartoned for protection.
B. Doors and frames shall have their wrappings or coverings removed upon delivery to the building site.
C. Store all materials in a dry covered area.
D. It shall be the responsibility of the General Contractor to promptly clean and touch up with a rust inhibitive primer any scratches or disfigurement caused in shipping or handling.
E. Place all materials on planking or blocking, at least 4" off of the ground, 2" off of a paved area or floor slab.
F. Do not store flat: Store doors and frames in an upright position with heads upper most.
G. Place no more than 5 single opening frames or 3 multi-opening frames in a group.
H. Provide, by means of wood strips, a space of at least 1/4" between all units to permit air circulation.

1.06 COORDINATION WITH OTHER WORK

A. The security hollow metal doors, door frames, and frames, Detention Equipment Contractor shall coordinate installation with Section 087163, SECURITY HARDWARE and Section 088853, SECURITY GLASS AND GLAZING.
B. Any problems with fire labeling of openings shall be presented to the Architect prior to the submittal process.

1.07 FIRE RATED DOORS AND FRAMES

A. The Contractor shall be responsible to make sure that all fire rated doors, frames and hardware that require a U.L. label can be labeled. If any door assembly cannot be labeled, the contractor must notify the architect with 10 days prior to bid day.

PART 2 - PRODUCTS

2.01 MATERIALS - SECURITY HOLLOW METAL FRAMES

A. Frames shall be combination type with integral trim fabricated of cold rolled, or hot rolled, pickled and oiled steel sheets with clean, smooth surfaces. Joints shall be of full welded unit type construction with contact edges closed tight and welds on exposed surfaces depressed smooth and flush. Fabricate molded members straight and true, with corner joints well formed and in true alignment and fastenings concealed where practicable. Finish work shall be strong, rigid, neat in appearance, and free of defects. Frames specified on the drawings as galvanized shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized.

B. Exterior and Interior Frames: Frames for exterior openings shall be made of commercial grade GALVANIZED OR GALVANEAL steel conforming to ASTM A366-72, except stainless steel where indicated. Interior frames for interior openings shall be either commercial grade cold rolled steel conforming to ASTM designation A366-72 or commercial grade hot rolled and pickled steel conforming to ASTM designation A569-72. Frames shall have fully mitered joints, including stops, and shall be continuously welded inside the miter across the full depth and width of the frame. Mullions, jambs, head, and sill shall be secured to walls and fully grouted.

C. Frames for Multiple or Special Openings: Shall have mullion and/or rail members which are closed tubular shapes, having no visible seams or joints on the faces. All joints between faces of abutting members shall be securely welded and finished smooth. Mullions, jambs, head, and sill shall be secured to walls and fully grouted.

D. Fabrication: Frames shall be shipped as a complete unit where possible. When shipping limitations so dictate. Frames for large openings shall be fabricated in smaller sections and designed for splicing in the field; factory prepared splices shall be field assembled.

E. Reinforcing: Frames shall be mortised, reinforced, drilled, and tapped at the factory for templated mortised hardware in accordance with the approved hardware schedules and templated provided by the subcontractor for this section. Where surface mounted hardware is to be applied, frames shall have reinforcing plates completely drilled and tapped for installation in the field.

F. Visitation frames shall have ¼” round opening on each side as indicated. Interior of frame shall have metal baffles so that there is no line-of-sight thru the frame plus an 8-mesh screen. Provide mortar box. (If Applicable)

G. Hinge Reinforcing: For mortise butts, provide a 7-gauge minimum x 1-1/2" x 10" long reinforcing plate, offset at each hinge location and factory drilled and tapped. A 12 gauge by 1-1/2" x 1-1/2" x 2" long angle reinforcement shall be welded in place between the center of the reinforcement and the inside trim face of the frame to prevent deformation of the hinge reinforcement and the inside trim face of the frame to prevent deformation of the hinge reinforcement under door load. A mortar guard shall be welded in place on the back of the reinforcement, and filled with a urethane foam to prevent grout from entering the screw holes prior to hardware installation.

H. Lock or Keeper Provisions: Lock or keeper preparation shall be in accordance with the recommendation of the hardware manufacturers. Reinforcements shall be not less than 7-gauge steel. All cutouts and reinforcements shall be protected with pressed steel mortar guards on the inside of the frame.

I. Floor Anchors: Shall be formed of not less than 12-gauge steel and shall be securely welded at the bottom of each jamb. Where so scheduled or specified, adjustable floor anchors extending down to below the finish floor and providing not less than 2" height adjustment shall be provided.

J. Anchor in Masonry: Frames for installation in masonry walls shall be provided with adjustable, non-removable jamb anchors of the strap and stirrup type made from the same gauge steel as frame. Strap shall be no less than 2" x 10" in size, corrugated and/or perforated. The number of anchors provided on each jamb shall be as follows:

Frames up to 7'6" height - 4
Frames from 7'6" to 8'0" height - 5
Frames over 8'0" height - 1 anchor for each 16" or fraction thereof

K. Stiffeners: All frames shall be provided with steel spreader angles, temporarily attached to the bottom of both jambs, one on each side of the opening to serve as a brace during shipping and handling. The steel spreaders shall be removed by the Contractor prior to setting frames.

L. Removable Security Glazing Stops: The removable glass stop shall consist of 10-gauge angle securely fastened to the frame using machine screws 1/4-28 or 1/4-20, 6 inches on center, a minimum of 3 inches from the corners. All exposed screw heads shall be round, pan, or oval type, stainless steel torx head with center pin security screws. The finished glass stop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames. There shall be a minimum of 1" glass engagement. Glazing stops shall be 1-1/4".

M. Finish: After fabrication, all tool marks and surface imperfections shall be removed and exposed faces of all welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum painted adhesion and shall be coated on all accessible surfaces with a rust inhibitive primer which meets or exceeds ASTM designation B-117, salt spray for 150 hours, and ASTM designation D-1735 water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.

N. All security hollow metal doors and frames shall be 12-gauge steel.

O. Any door and frame and security furniture and accessories located within inmate areas shall have stainless steel torx head with center pin security screws.

P. Provide grout covers for all door and window frames. On each frame, provide grout covers for all silencers and screws. Grout covers for security screws shall be steel and welded to frames.

2.02 MATERIALS - SECURITY HOLLOW METAL DOORS

A. Doors shall be of types, sizes, and designs noted, fabricated of cold rolled, picked and oiled stretcher leveled steel sheets with clean, smooth surfaces. Metal thickness for doors shall be as indicated on the drawings. Phosphate treat metal prior to painting. Finished work shall be rigid, neat in appearance, and free of defects. Form molded members straight and true, with joints coped or mitered, well formed, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth, to be invisible. Doors specified as galvanized shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized.

B. Door Faces: Shall be of commercial quality leveled cold rolled steel conforming

to ASTM designation A366-72 or hot rolled pickled and oiled steel conforming to ASTM designation A569-72 and shall be free of scale, pitting or other surface defects. All security hollow metal doors shall be as indicated on plans.

C. All doors shall be custom made full flush design, internally reinforced, sound deadened, insulated, and thickness as indicated on the drawings. Doors shall receive security hardware of the types and sizes shown on the approved shop drawings and schedules. Note: Manufacturer shall coordinate frame dimensions to thickness of door.

D. Appearance: All doors shall be strong, rigid, and neat in appearance, free from warpage, wind, or buckle. All bends shall be true and straight and of minimum radius of the gauge of metal used.

E. Construction: Doors shall have mild steel face sheets continuously welded on edges and finished smooth so that there are no visible seams. The door shall be stiffened by continuous vertical formed steel sections which, upon assembly, shall span the full thickness of the interior space between door faces. The stiffener shall be 18 gauge minimum, spaced so that the vertical interior webs shall be no more than 4" OC and securely fastened to both face sheets by spotwelds spaced a maximum of 3" OC vertically. Spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt type material.

F. Edges: Vertical door edges shall be beveled 1/8" in 2" and shall be reinforced by a continuous steel channel, not less than 10 gauge, extending the full length of the door welded not more than 3" on center inside the door faces. Top and bottom door edges shall be closed with continuous recessed 10-gauge channels extending the full width of the door and welded 3" on center maximum to both faces and continuously welded to the vertical door edge channels to form a single perimeter frame inside the door.

G. Closer Channel: The top end channel shall be fitted with an additional flush closing channel of not less than 16 gauge. The flush closing channel shall be welded in place at the corners and at the center. Installation of the closer channel using screws, security or otherwise, shall be deemed unacceptable. The end channel and flush closer channel shall be installed so that they are permanent and non-removable.

H. Door Edges: Shall be mortised and accurately cut, reinforced, drilled, and tapped to receive templated mortised hardware in accordance with the approved hardware schedule and the hardware manufacturer's recommendations for the proper installation of all hardware and prison equipment. Where surface mounted hardware is to be applied, the manufacturer shall provide reinforcement plates only, and drilling and tapping shall be done in the field by the hardware installer.

I. Removable Security Glazing Stops: The removable glazing stop shall consist of 10-gauge angle securely fastened to the frame using machine screws 1/4-28 or 1/4-20, 6 inches on center, a minimum of 3 inches from the corners. All screws shall be round, pan, or oval type, and shall be stainless steel torx head with center pin security screws. The finished glass stop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames. There shall be a minimum of 1" glass engagement. Glazing stop depth shall be 1-1/4".

J. Finish: After fabrication, all tool marks and surface blemishes shall be filled and sanded as required to make both faces and both vertical edges smooth and free of

irregularities. After appropriate preparation, all exposed surfaces shall receive 2 shop coats of rust inhibitive primer which meets or exceeds ASTM designation B-117, salt spray for 150 hours ASTM designation D-1735, water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.

K. All security hollow metal doors and frames shall be 12-gauge steel.

PART 3 - EXECUTION

3.01 CLEANING AND PAINTING

A. Upon completion of installation, surfaces of doors and frames which have been completely primed shall be thoroughly cleaned and touched up, as recommended by door manufacturer.

3.02 INSTALLATION

A. The General Contractor shall install frames in strict accordance with the following tolerances:

Plumbness:		± 1/16"
Squareness	:	± 1/16"
Alignment:		± 1/16"
Twist:		± 1/16"

Plumbness, squareness, alignment, and twist methods of measurements are defined in NAAMM, CHM-1-74.

B. The location of hardware on doors and frames shall be as follows:

Hinges: Top	-	5" from head of frame to top of hinge
Bottom	-	10" from finished floor to bottom of hinge
Intermediate	-	centered between top and bottom hinges
On Dutch Doors	-	5" from head of frame to top of hinge
	-	10" from finished floor to bottom of bottom hinge
	-	5" from split line to top and bottom respectively of lower and upper intermediate hinges
Unit and integral		
Type locks and latches	-	38" to centerline of knob
Deadlocks	-	60" to centerline of cylinder
Panic hardware	-	38" to centerline of cross bar
Door pulls	-	42" to center of grip
Push-pull bars	-	42" to centerline of bar (from finished floor)
Arm pulls	-	48" to centerline of plate
Roller latches	-	45" to centerline

C. Edge clearance shall be provided as follows:

Between doors and frame, at head and jambs 1/8"

At door sills: where no threshold is used, 3/8" maximum; where threshold is used, 3/4" max. above finished floor

Between meeting edges of pairs of doors 1/8"

Finished floor is defined as the top surface of the floor, except when resilient tile or carpet is used, when it is the top of the concrete slab. Where the carpet is

more than 1/2" thick, allow 1/4" clearance.

D. It shall be the responsibility of the Contractor to provide metal hinge shims and make adjustments as necessary to provide clearances a required. Methods of adjustment shall be as recommended and defined by NAAMM CHM-1-74.

E. Mullions, jambs, head, and sill of frames shall be secured to walls and fully grouted.

F. The security hollow metal manufacturer shall coordinate with the security hardware manufacturer to insure proper operation of door frame and lock function.

END OF SECTION 081123

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Unit skylights mounted on prefabricated curbs.

1.02 SUBMITTALS

A. Product Data: For each type of unit skylight indicated.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Self-Ignition Temperature: 650 deg F (343 deg C) or more for plastic sheets in thickness indicated when tested per ASTM D 1929.
2. Smoke-Production Characteristics: Comply with either requirement below:
   a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
   b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
3. Burning Characteristics: Tested per ASTM D 635.
   a. Acrylic Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
   b. Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.

C. Unit Skylight Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products as follows:

1. Babcock-Davis nominal 60” X 60” venting skylights part #BSVLA 60X60 D2L165R-LPCC with burglar bars, ½” round steel bars 6”o.c. one way with opposite way spaced as required. Fully welded.
2. Smoke venting shall operate by fusible link (set of 165ºF) and

electrically.

3. Coordinate installation with roof curb installed with roofing.

2.02 MATERIALS

A. Aluminum Components:

1. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad Alloy 3005-H25.
2. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52.

B. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

2.03 GLAZING

A. Glazing: Polycarbonate, clear double down.

B. Glazing Gaskets: Manufacturer's standard.

2.04 INSTALLATION MATERIALS

A. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil (0.4-mm) dry film thickness per coating.

B. Joint Sealants: As specified in Division 07 Section "Joint Sealants."

C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

D. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

2.05 UNIT SKYLIGHTS

A. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.

B. Unit Shape and Size: As specified.

C. Condensation Control: Fabricate unit skylights with integral internal gutters and non-clogging weeps to collect and drain condensation to the exterior.

D. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.

2.06 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

3.02 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions.

END OF SECTION 086200

SECTION 087100 - DOOR HARDWARE

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. Electrified door hardware.

B. Related Requirements:

1. Section 064113 "Wood-Veneer-Faced Architectural Cabinets" for cabinet door hardware provided with cabinets.
2. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
3. Section 081213 "Hollow Metal Frames" for door silencers provided as part of hollow-metal frames.
4. Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.
5. Section 081416 "Flush Wood Doors" for provided as part of labeled fire-rated assemblies.
6. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.4 PREINSTALLATION MEETINGS

A. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

    a. Flow of traffic and degree of security required.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying

diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.
d. Concealed Floor Closers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lb. to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3.

2.4 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially

recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.5 KEYING

A. All lockets and IC cylinders shall be master keyed.
B. Permanent keying shall be handled between the owner, the architect, and the lock supplier.
C. Provide the following keys:
   1. Six master keys.
   2. Three change keys per cylinder or lockset.

2.6 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches .

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Key Control System:

1. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
2. Key Control System Software: Set up multiple-index system based on final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 FINISH HARDWARE SCHEDULE

HARDWARE SET BH-1

3	Each	Hinges	CB179NRP 4.5 X 4.5	626
1	Each	Lockset	9080R X 03L (except 9082 at door 208A)	630
1	Each	Stop	406	626
1	Each	Silencers	608	G.R.

HARDWARE SET BH-2

3	Each	Hinges	CB179NRP 4.5 X 4.5	626
1	Each	Lockset	L9082R X 03L	630
1	Each	Closer	4040XP	689
1	Each	Stop	406	630
3	Each	Silencers	608	

HARDWARE SET BH-3

3	Each	Hinges	CB179NRP 4.5 X 4.5	626
1	Each	Passage	L9450 X 03	630
1	Each	Stop	406/443	626
3	Each	Silencers	608	G.R.

HARDWARE SET BH-4

3	Each	Hinges	CB179NRP 4.5 X 4.5	626
1	Each	Lockset	L9040 X 03L	630
1	Each	Stop	406	626
3	Each	Silencers	608	G.R.

HARDWARE SET BH-5

6	Each	Hinges	CB191NRP 4.5 X 4.5	626
1	Each	Lockset	L9080R X 03L	630
1	Each	Dummy Knob	L9176	
1	Each	Flushbolts	555 12”	
1	Each	Dust-proof strike	570	

2	Each	DPS	201020 X TORX	
2	Each	Floor Stops	467	
1	Each	Threshold	8965 X 72	
1	Set	Door Seals	127NA X 20’-0”	

HARDWARE SET BH-6

3	Each	Hinges	CB191NRP 4.5 X 4.5 (344A, 343A – 4 HINGES)	626
1	Each	Lockset	L9080 X 03L	630
1	Each	DPS	201020	689
1	Each	Stop	406/443	630
1	Each	Threshold	896S X 36”	628
1	Set	Door Seals	127NA X 17’0”	628

END OF SECTION 087100

SECTION 087163 - SECURITY HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work required under this section consists of furnishing security hardware and the installation of security hardware and related items necessary to complete the work indicated on the drawings and described in this Specification.

B. Where builder type hardware is required in a security hardware set, it shall be furnished hereunder as listed for the specific case.

C. The provision under Section 081123, "Security Hollow Metal Doors and Frames," shall apply to work specified in this section.

D. All locksets (swinging or sliding) shall be by the same manufacturer.

E. Doors listed in the "Door Schedule" shall meet U.L. requirements. Otherwise, Architect/Engineer shall be notified why they cannot be rated at least 10 days prior to bid date.

1.02 APPLICABLE PUBLICATIONS

A. All work shall be done in accordance with the following publications:

1. The National Association of Architectural Metal Manufacturers. (NAAMM)
2. American National Standard Institute A115.1 - 1982.
3. Door and Hardware Institute, "Recommended Location for Builders' Hardware for Custom Steel Doors and Frames."
4. Door and Hardware Institute, 8P, "Hardware for Labeled Fire Doors."
5. ANSI A156.1 - 1981, "Butts and Hinges."
6. ANSI A156.4 - 1980, "Door Controls - Closers."
7. ANSI A156.5 - 1984, "Auxiliary Locks and Associated Products."
8. ANSI A156.6 - 1986, "Architectural Door Trim."
9. ANSI A156.7 - 1981, "Template Hinge Dimension."
10. ANSI A156.13 - 1980, "Mortise Locks & Latches."
11. ANSI A156.15 - 1981, "Closer Holder Release Devices."
12. ANSI A156.16 - 1981, "Auxiliary Hardware."
13. N.F.P.A. 80 - 1985 Edition, Volume 4.

1.03 APPROVED MANUFACTURERS

A. For the electrical or mechanical security locks, individual control devices, miscellaneous security hardware are as follows:

1. Southern Steel Company
2. R.R. Brink's Locking Systems
3. Midwest Portland
4. Airteq Systems

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include information necessary to show compliance with specifications, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit final hardware schedule in manner indicated below.

Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.

1. Final Hardware Schedule Concern: Based on finish hardware specified, organize hardware schedule into "hardware sets" indicating complete designations of every item for each door or opening. Include the following information:
   a Type, style, function, size and finish of each hardware item.
   b Name and manufacturer of each item.
   c Fastenings and other pertinent information.
   d Location of hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
   e Explanation of all abbreviations, symbols, and codes contained in schedule.
   f Mounting locations for hardware.
   g Door and frame sizes and materials.
   h Keying information.

1.05 PRODUCTS

A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.06 KEYING

A. Keying shall be in accordance with the Door and Hardware Institute manual, “Keying - Procedures, Systems and Nomenclature”.

B. Individual keying of all cylinders shall be only as directed by the Architect and Owner. It is required that a meeting be arranged with the Architect and Owner to lay out the required keying systems. A complete keying schedule shall be submitted for review and approval by the Architect and Owner after this meeting.

C. Furnish six (6) master keys. Unless indicated otherwise, six (6) keys for each key set will be provided.

D. The representative of the security hardware manufacturer or supplier who is designated to supervise the installation of locks shall be responsible for the day keys and shall set up the key control system specified below.

E. LETTER OF CERTIFICATION: As a condition of Owner Acceptance, ALL keys, including masters and grandmasters, shall be turned over to the Owner on the day of acceptance. Key turnover must be accompanied by a letter from the manufacturer (not a vendor or representative) which includes a list of all keys, by mark and quantity, produced for this project. The letter must certify that these are all of the keys produced for this project by this manufacturer. The letter must bear the signature of an officer of the manufacturer and be notarized.

F. Furnish a complete key control cabinet for control room to accommodate all

security hardware keys and all builder's hardware keys for the project. The system shall be furnished with a capacity of 1.75 times the number of door locks. Each cabinet shall have high security manipulation resistant combination lock. System shall include completely set up three (3) way cross index system, installation of keys and dual tag system, and instructions to the Owner on proper use of the system. Acceptable manufacturers: Telkee, Inc. or Key Control Systems, Inc.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hinges: 4-1/2" x 4-1/2" ball bearing construction with stainless steel non-removable pin, materials steel, standard template screw location, security type (Spanner) flat head screws. Non-removable pin shall be held in place with a concealed pin, not a set screw. Acceptable manufacturers: Brinks 4.5FMSS or approved equal.

B. Surface and Concealed Door Closers:

1. Security Type: Hydraulic closers with heavy steel, fully enclosed cover, high strength cast iron cylinder having full rack and pinion operation, non-critical and independent tamper-proof regulating screws for adjustment of latch speed, general speed, back-check and spring power (50% increase). All closers shall have forged steel arms, "pinned" arm connections with steel roll pins to prevent disassembly of arm components, and "TORX" security fasteners. Full enclosed drawn steel cover shall be secured to closer body with four (4) Torx bolts (LCN Series 4210/4510); no substitution.
2. All surface closers (security and non-security) shall be the products of one manufacturer.
3. Provide mounting plates as required and shoulder through bolts (STB) for application to hollow metal doors.
4. All closers shall be warranted for a period of ten (10) years and tested for ten (10) million closing cycles.
5. Acceptable manufacturers: LCN Closers, Series 4210, 4510, 2210, 2210 DPS.
6. Provide a door closer for all fire rated doors, regardless if not shown within the hardware sets.

C. Electro-Mechanical Motor Lock: Maximum security electric controlled jamb mounted lock with automatic deadlocking. Minimum functions and features shall be as follows:

1. The lock shall be the automatic deadlocking latch type. The latch shall be retractable by either motor or key operation. No greater than 1/16" depression of the auxiliary latch shall fully deadlock the latch and prevent its retraction by end pressure when in the projected position.
2. The lock shall be installed by mortising into the rabbet of the jamb at the lock rail height. The mounting of the lock shall not require a special pocket and/or cutting into the stop, trim, or backbend of the frame (except to provide a hole for the key cylinder of the lock). When the door is closed and locked, all lock attachment screws shall be inaccessible.

3. The latchbolt shall have a 3/4" throw.
4. The lock shall contain a limit switch actuated by the auxiliary and latchbolts. This switch will serve to control a signal light to indicate unlocked and deadlocked condition of the lock.
5. The lock shall be furnished with a plug connection for field wiring hookup. All wires leading from the lock shall be color coded and encased in heat shrinkable tubing and shall terminate into a plug. A mating socket with corresponding color-coded lead wires shall be furnished for connection to the field wires without the presence of the lock.
6. The lockbolt and the lock shall not be accessible to the inmate in the locked and closed position.
7. Acceptable Manufacturers:
   a Southern Steel or R.R. Brinks.

D. Mechanical Door Position Switch: The Mechanical door position switch shall be concealed in the head of the door frame. In any case, the door position switch shall be tamperproof. The switch shall be adjustable so that indication is shown when the door is ajar one-half inch or more.
1. Basis of Design
   a Brink 201030
   b Southern Steel 240CPS Concealed Positions Switch.

E. Door Pull:
1. Material: Manganese bronze, satin finish (approximately US4).
2. Acceptable Manufacturer:
   a “D” Ring: Southern Steel # 212C or Brink No. 300021.
   b Flush: Southern Steel # 214B or Brink No. 300011.

F. Door Stops: Ives FS18S or FS185L as required.

G. Silencers: Gray rubber or neoprene, tamperproof 1/8" air cushion. Glynn Johnson 64 or equal. Provide weld plates for all door silencers.

H. Weatherstripping Threshold: Aluminum extrusion minimum thickness. .160"; 5" wide, 1/2" rise with "panic" stop and vinyl or neoprene weatherstripping insert. National Guard 896V or equal. Weatherstripping shall be secured with Spanner head screws.

I. Weatherstripping Set for Head and Jamb: Aluminum extrusion (clear anodized) with vinyl insert for frame mounting. National Guard 190A or equal. Weatherstripping shall be secured with Spanner head screws.

J. Fire Rated Doors and Frames:
1. The Contractor shall be responsible to make sure that all fire rated doors, frames and hardware that require a U.L. label can be labeled. If any door assembly cannot be labeled, the Contractor must notify the architect within 10 days prior to bid day.

K. Door Closers
1. All closers shall be heavy duty, surface mounted, hydraulic type, with full rack and pinion construction.
2. Size all closers, at time of installation, in accordance with the manufacturer’s recommendations at the building site.
3. All closers shall be the product of a single manufacturer.
4. The closers shall have adjustable spring power, which allows for closer sizing. Closers shall have separate tamper resistant, non-critical

regulating screw valves for closing speed, latching speed, and back check control as standard feature.

5. Acceptable products subject to compliance with above requirements:
   LCN (No substitutions)
   2215 DPS
   4210
   4510

2.02 SECURITY HARDWARE SCHEDULE

HARDWARE SET SH-1

Each shall have:

3	Each	Hinges	4.5FMSS X ¼-20 TORX	630
1	Each	Lockset	5026M X MCLH-M X 120VAC X MOGUL	626
1	Each	DPS	201030 X TORX	628
1	Each	Closer	4210 X TORX	689
2	Each	Door Pull	300021 X TORX	630
1	Each	Floor Stop	FB18S	628
1	Each	Threshold	896S X 36” (omit on doors 170A & 179B)	628
1	Set	Door Seal	127NA X 17’-0” (omit on doors 170A & 179B)	628

HARDWARE SET SH-2

Each shall have:

3	Each	Hinges	4.5FMSS X ¼-20 TORX	630
1	Each	Lockset	5026M X MCLH-M X 120VAC X MOGUL	626
1	Each	DPS	201030 X TORX	628
1	Each	Closer	4210/4510 X TORX	689
2	Each	Door Pull	300021 X TORX	630
1	Each	Floor Stop	FB18S	628
3	Each	Silencers	608	G.R.

HARDWARE SET SH-3

Each shall have:

3	Each	Hinges	4.5FMSS X ¼-20 TORX	630
1	Each	Lockset	5022M X MCLH-M X 120VAC X MOGUL	626
1	Each	DPS	201030 X TORX	628
1	Each	Door Pull	300021 X TORX	630
1	Each	Flush Pull	300011 X TORX	630
1	Each	Floor Stop	FB18S	628
3	Each	Silencers	608	G.R.

HARDWARE SET SH-4

Each shall have:

4	Each	Hinges	4.5FMSS X ¼-20 TORX	630
1	Each	Lockset	7076 X HM X KS	626

HARDWARE SET SH-5

3’0” X 7’0” X 2” SHMF X SHMD
Each shall have:

1	Each	Sliding Device	57700CD/U X CONTINUOUS COVER BOX X WIRING HARNESS X CABLE TRAYS	600
1	Each	Door Pull	30021 X TORX	630
1	Each	Flush Pull	30011 X TORX	630

HARDWARE SET SH-6

Chainlink swinging gate
Each shall have:

1	Each	Lockset	8052-K25 (keyed both sides)	Slider

2.04 SECURITY SCREWS

A. All security furniture, accessories, hardware, etc., located within any inmate area, corridors, dayrooms, cells, exercise yards, multipurpose rooms, visitation, kitchen, library, etc., shall have stainless steel torx head with center pin security screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The electrical circuits for each and every locking system shall be tested by the representative of the security hardware manufacturer or supplier and shall be certified as having compatible voltage, protection against overload and duty cycle capability consistent with the operation and installation.
B. The security hardware manufacturer shall review the control consoles shop drawings, other devices, and systems as being compatible with all security hardware.
C. Wiring diagrams for all locks shall be prepared by the manufacturer. These wiring diagrams shall be reviewed and approved by the security hardware manufacturer for correctness with respect to lock functions, monitoring requirements, number of conductors, and connection points. No deviations, modifications, or changes from the information contained in the approved shop drawings and wiring diagrams shall be allowed. In the event hardware manufacturing changes, which occur after approval of shop drawings or wiring diagram require any additional costs to the Project, such additional costs shall be borne by the security hardware manufacturer.
D. The security hardware manufacturers shall review and approve all hollow metal door and frame shop drawings for proper acceptance of the security hardware. If modification must be made to the doors and frame during construction for proper hardware operation, there shall be no additional cost to the Owner. The security hardware manufacturer shall provide a complete set of templates to the security hollow metal manufacturer.

END OF SECTION 087163

SECTION 088853 - SECURITY GLASS AND GLAZING

PART 1 - GENERAL

1.01 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. Federal Specifications (Fed. Spec.):
DD-G-451D: Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors and Other Uses)
DD-G-1403C: Glazing, Float, Sheet, Figured, Coated (Heat-Strengthened and Tempered)
TT-G-410E: Glazing Compound, Sash (Metal) for Back Bedding and Am 1 and Facing Glazing (Not for Channel or Stop Glazing)

B. Military Specification (Mil. Spec.):
MIL-R-900F: Rubber Gasket Material, 45 Durometer Hardness
MIL-P-46144B: Plastic Sheet, Polycarbonate

C. Consumer Products Safety Commission (CPSC) Publication:
16 CFR, Part 1201: Safety Standard for Architectural Glazing Materials, January 1982

D. American Society for Testing and Materials (ASTM) Publications:
C 106-85: Standard Specification for Flat Glass
C 920-79: Elastomeric Joint Sealants
D 673-70: Mar Resistance of Plastics
D 790-84A: Test Method for Flexural Properties
D 1003-77: Test Method for Haze and Luminous Transmittance of Transparent Plastics
C 1048-85

E. American National Standard Institute
Z 26.1: 1983 Safety Code for Safety Glazing Materials (Test #1, #2, #3, #4, and #21)

F. American Architectural Manufacturer's Association (AAMA) Publication:
SC-1: Preformed Channels

G. National Fire Protection Association (NFPA) Publication:
80-81: Fire Doors and Windows
NFPA 252 - Fire Test of Door Assemblies
NFPA 257 - Fire Test of Window Assemblies

H. Flat Glass Marketing Association (FGMA) Publication:
1980: Glazing Manual

1.02 SUBMITTALS

A. Manufacturer's Data: Include glass manufacturer's printed literature for setting and sealing materials and for installation of each type of glazing material specified.

B. Manufacturer's Guarantees: Guarantee glass units against development of material obstruction to vision as a result of delamination, other than through glass breakage, within a 5-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this guarantee within 45 working days after receipt of notice from the using agency.

1.03 DELIVERY AND STORAGE

A. Deliver products to the site in unopened containers, labeled plainly with manufacturer's names and brands. Store glass and setting materials in safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

B. Protect glass and glazing materials during delivery, storage and handling, to comply with manufacturer's direction and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.04 QUALITY ASSURANCE

A. Glazing Standard: Comply with recommendations of Flat Glass marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR part 1201 for category II materials.

C. Single Source Responsibility: Provide materials obtained from one source for each type of glass and glazing products indicated, and for visually related areas.

D. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Global Security Glazing
2. Dlubac Corporation
3. The LTI Group
4. Cardinal Glass Industries

PART 2 - PRODUCTS

2.01 POLYCARBONATE SHEET GLASS

A. Shall be extruded monolithic polycarbonate sheet, UV stabilized coated on both faces with mar surface treatment. Product must conform with ICBD, BOCA, and SBCCI Model Building Codes as an approved light. Transmitting plastic with a CC-1 flammability performance level.

2.02 LAMINATED POLYCARBONATE

A. Shall be extruded monolithic polycarbonate sheet, UV stabilized but laminated together using an interlayer of LR Resin. Thickness will vary according to manufacturer's requirements to meet finished product description in Section 2.8. Polycarbonate laminates shall have a flexural strength not less than 13,500 PSI; (ASTM D-790), 180 Degrees Fahrenheit allowable continuous service temperature.

Products must conform with ICBO, BOCA, and SBCCI Model Building Codes as an approved light transmitting plastic with a CC-1 flammability performance

level.
Exterior surfaces shall be treated with a high mar-resistant, or equal coating. Abrasion resistance to be measured per ANSI 266.1 Test #17 (Taber Abrader).

2.03 GLASS COMPOSITION

A. ¼" and ½" Nominal, monolithic mar resistant polycarbonate (MR-10):
   1. ¼" or ½" Mar resistant polycarbonate.

B. 1/2" Nominal, 3 ply laminate mar resistant polycarbonate (MPC-500):
   1. 1/8" mar resistant polycarbonate.
   2. .015 LR resin interlayer.
   3. 1/4" polycarbonate.
   4. .015 LR resin interlayer.
   5. 1/8" mar resistant polycarbonate.

2.04 SECURITY SCREWS

A. All security furniture, accessories, hardware, etc., located within any inmate area, corridors, dayrooms, cells, exercise yards, multipurpose rooms, visitation, kitchen, library, etc., shall have stainless steel torx head with center pin security screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Glazing Sealants:
   1. General: Comply with recommendation of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.
   2. Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.
      a Colors: Provide color of exposed sealant as selected by Architect from Chemically Strengthened Glass's standard colors.
      b Silicone Glazing Sealant: Single component elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag; and with ASTM C 920, Type S, Grade NS, Class 25, Use G and, as applicable to use indicated, Uses A and O; and with the following requirements:
         1 High-Modulus Silicone Glazing Sealant Manufacturer's standard high-modulus acid-curing sealant.
      c Preformed Buyl-Polyisobutylene Glazing Tape: Blend of butylpolyisobutylene rubber with solids content of 100%, in extruded tape form, complying with AAMA 807.1, packaged on rolls with a release paper on side, with or without continuous spacer rod as recommended by manufacturers of tapes and glass for application indicated.

3.02 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Provide materials with proven record of compatibility with surface contacted in installation.

B. Cleaners, Primers, and Sealers: Type recommended sealant or glass manufacturer.
C. Setting Blocks: Neoprene, EPDM, or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore a durometer hardness. Size of blocks shall be 1/4" x 1/2" x 4".
D. Edge Block: Neoprene, EPDM, or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

3.03 INSPECTION

A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed unless unsatisfactory conditions have been corrected. Contractor to coordinate inspection with architect. First piece of glass to be set in presence of the Owner. Provide at least 7 days' notice.

3.04 PREPARATION

A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer form metal surfaces where elastomeric sealants are indicated for use. Frames and stops must be painted prior to installation of glazing.

3.05 GLAZING GENERAL

A. Comply with combined printed recommendations of glass manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those referenced glazing standards.
B. Glazing channel dimensions as detailed by supplier to provide for 1" bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Contractor must comply with manufacturer's recommendations and coordinate with hollow metal details.
C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Glass shall not impact metal framing. Use suction cups to shift glass units within openings; do not raise or shift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by sealant-substrate testing.

3.06 GLAZING

A. Install setting blocks of proper size in sill rabbet, located one-quarter of glass width from each corner, but no closer than 6" unless otherwise required. Set

blocks in thin course of sealant which is acceptable for heel bead use.

B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

D. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

E. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond or sealant to glass and channel surfaces.

F. Tool exposed surfaces of sealants to provide a substantial "wash" way from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

G. Provide continuous 1/2" glazing tape, both sides, with forced sealants above tape not less than 1/4" in stop. Use 4" long, 1/4" setting blocks on 1/4 points at sill and jamb.

3.07 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, scratched, gouged, cut, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

E. Wash and clean glass, interior and exterior, on both faces not more than 4 days prior to date scheduled for inspections intended to establish data of Owner's acceptance in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 088853

SECTION 092900 - GYPSUM BOARD AND METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Non-load-bearing steel framing members for gypsum board assemblies.
   2. Gypsum board assemblies attached to steel framing.
   3. Gypsum board assemblies attached to furring members.

1.02 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.03 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Sound Transmission Characteristics: For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency.

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
   1. Product data for each type of product specified.
   2. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire Resistance Ratings: As indicated by reference to design designations in UL "Fire Resistance Directory".

C. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.

D. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

E. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.07 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less that 40NF (4NC). For adhesive attachment and finishing of gypsum board, maintain not less than 50NF (10NC) for 48 hours prior to application and continuously after until dry. Do not exceed 95NF (35NC) when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Steel Framing and Furring:
   a. Clark Steel Framing.
   b. Consolidated Systems, Inc.
   c. Dietrich Industries, Inc.
   d. Marino Industries Corp.
   e. Gold Bond Building Products Div., National Gypsum Co.Unimast Inc.
2. Grid Suspension Assemblies:
   a. Chicago Metallic Corp.
   b. National Rolling Mills Co.
   c. USG Interiors, Inc.
3. Gypsum Board and Related Products:
   a. Georgia-Pacific Corp.
   b. Gold Bond Building Products Div., National Gypsum Co.
   c. United States Gypsum Co.

2.02 STEEL FRAMING COMPONENTS FOR SUSPENDED & FURRED CEILINGS

A. General: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

B. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

D. Hanger Rods: Mild steel and zinc-coated or protected with rust-inhibitive paint.

E. Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.

F. Channels: Cold-rolled steel, 0.05980" minimum thickness of base (uncoated) metal and 7/16" wide flanges, and as follows:

1. Carrying Channels: 1-1/2" deep, 475 lb per 1000 feet, unless otherwise indicated.
2. Finish: Rust-inhibitive paint, unless otherwise indicated.
3. Finish: G 60 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits.

G. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90N and doubled over to form 3/16" minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: 22 gauge, unless otherwise indicated.
2. Depth: 3-5/8", unless otherwise indicated.
3. Protective Coating: G 40 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits and ceiling suspension members in areas within 10' of exterior walls.

H. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8", and minimum thickness of base (uncoated) metal as follows:
1. Thickness: 22 gauge, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant coating.

I. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 525 or ASTM A 568 to form 1/2" deep channel of the following configuration:
1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).
2. Double-Leg Configuration: Hat-shaped channel, with 1-1/2" wide face connected to flanges by double slotted or expanded metal legs (webs).
3. Configuration: Either configuration indicated above.

J. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

2.03 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:
1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:
a. Maximum Deflection: L/240 at 5 lbs per SF.
2. Protective Coating: Manufacturers standard corrosion-resistant coating.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90N and doubled over to form 3/16" wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth.
1. Thickness: 22 gauge interior and 16 gauge exterior, unless otherwise indicated.
2. Depth: as indicated.

C. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Depth: 7/8".
2. Thickness: 22 gauge, unless otherwise indicated.

D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 525 or ASTM A 568 to form 1/2' deep channel of the following configuration:
1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single slotted leg (web).
2. Double-Leg Configuration: Hat-shaped channel, with 1-1/2" wide face connected to flanges by double-slotted or expanded metal legs (webs).
3. Configuration: Either configuration indicated above.

E. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.04 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

2.05 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M
1. Manufacturers:
a. CertainTeed Corporation
b. Georgia-Pacific Gypsum LLC
c. National Gypsum Company
d. USG Corporation
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

B. Impact Resistant Gypsum Board: ASTM C 1396/C 1396M Gypsym Board, tested according to ASTM C 1692C/ 1629M.
1. Manufacturers:
a. CertainTeed Corporation
b. Georgia-Pacific Gypsum LLC
c. National Gypsum Company
d. USG Corporation
2. Core: 5/8 inch, Type X
3. Surface Abrasion: ASTM C 1692/C 1629M, meets or exceeds Level 2 requirements.
4. Indentation: ASTM C 1629/c 1629M, meets or exceeds Level 2 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
6. Hard-Body Impact: ASTMC 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
7. Long Edges: tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Manufacturers:
a. CertainTeed Corporation
b. Georgia-Pacific Gypsum LLC
c. National Gypsum Company
d. USG Corporation
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D3274.

2.06 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides with manufacturer's standard edges.
1. Manufacturers:
a. CertainTeed Corporation
b. Georgia-Pacific Gypsum LLC
c. National Gypsum Company
d. USG Corporation
2. Core: 5/8 inch, Type X.

.

2.07 TRIM ACCESSORIES

A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
   1. Material: Formed metal, plastic, or metal combined with paper, with the following requirement:
      a. Sheet Steel zinc-coated by hot-dip process.
   2. Shapes indicated below by reference to Fig.1 designations in ASTM C 1047:
      a. Cornerbead on outside corners, unless otherwise indicated.
      b. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
      c. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.
   3. Zinc accessories for Exterior Ceilings: Corner beads, edge trim , and control joints from rolled zinc complying with ASTM C 1047, in shapes indicated below by reference ASTM C 1047:

B. Corner bead on outside corners, unless otherwise indicated.

C. Edge trim complying with ASTM C 1047, formed from rolled zinc, shape LC-Bead per Fig.1, unless otherwise indicated.

2.08 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   1. Where setting-type joint compounds are used as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
   2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
   3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
   4. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.
   2. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

3. Topping compound formulated for fill (second) and finish (third) coats.
4. All-purpose compound formulated for both taping and topping compounds.

2.09 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
B. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.
C. Steel drill screws complying with ASTM C 1002 for the following applications:
   1. Fastening gypsum board to steel members less than 0.03" thick.
   2. Fastening gypsum board to gypsum board.
D. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033" to 0.112" thick.
E. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, case-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.03 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if non available, with "Gypsum Construction Handbook" published by United States Gypsum Co., 1987 Edition.
C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
   1. Where building structure abuts ceiling perimeter or penetrates ceiling.
   2. Where partition framing and wall furring abut structure except at floor.
D. Do not bridge building expansion and control joints with steel framing or furring members as indicated.

3.04 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspensions members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-typing, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angel, channel, and rod hangers to structure, including intermediate framing members by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Do not connect or suspend steel framing from ducts, pipers or conduit.

B. Sway-brach suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers; 0.1620" (8 gauge) diameter, 4' o.c.
2. Carrying Channels (Main Runners): 1-1/2", 4' o.c.
3. Rigid Furring Channels (Furring Members): 24" o.c.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8" in 12' measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. For exterior soffits, install cross-bracing and additional framing to resist wind uplift according to details on Drawings.

3.05 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8" from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceiling, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2" short of full height. Continue framing over

frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum, loading requirements specified.

F. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

G. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.06 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

E. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16" of open space between panels. Do not force into place.

F. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite side of partitions. Avoid joints at corners of framed openings where possible.

G. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. Attach gypsum panels to framing provided at openings and cutouts.

I. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32" wide. apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

J. Form control joints and expansion joints at locations indicated and as detailed on the drawings, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

1. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.) except in chase walls that are braced internally.

a. Except where concealed application is indicated or required for

sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 SF in area.

b. Fit gypsum panels around ducts, pipes, and conduits.

c. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4" to 1/2" wide joints to install sealant.

K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4" to 1/2" wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.07 GYPSUM BOARD APPLICATION METHODS

A. Single Lay Application: Install gypsum wallboard panels as follow:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

B. Double-Layer Application: Install gypsum backing board for base layers and gypsum wallboard for face layers.

1. On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints at least 10" from parallel base-layer joints. apply base layers at right angles to framing members unless otherwise indicated.

2. On partitions/walls, apply base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

1. Fasten with screws.

D. Double-Layer Fastening Methods: Apply base layer of gypsum panels and face layer to base layer as follows:

1. Fasten both base layers and face layers separately to supports with screws.

E. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered over supports. Install with 1/4" open space where panels abut other construction or structural penetrations.

1. Fasten with corrosion-resistant screws.

3.08 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's direction for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting

substrate.

2. Install L-bead where edge trims can only be installed after gypsum panels are installed.

D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angels, flanges of corner beads, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damages areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints except those with accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated and sound-rated assemblies.
2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
3. Level 3 for gypsum board surfaces for surfaces receiving medium or heavy textured finishes before painting.
4. Level 4 for gypsum board surfaces for surfaces receiving light-textured finishes, wallcoverings, and flat paints over light textures.
5. Level 5 for gypsum board surfaces receiving gloss and semigloss enamels and nontextured flat paints.

E. For Level 4 gypsum board finish, embed tape in joint compound and apply three separate coats of joint compound over joints, angels fastener heads, and accessories. touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use one of the following joint compound combinations.

1. Embedding and First Coat: Setting-type joint compound.
   Fill (Second) Coat: Setting-type joint compound.
   Finish (Third) Coat: Sandable, setting-type compound.
2. Embedding and First Coat: Setting-type joint compound.
   Fill (Second) Coat: Setting-type joint compound.
   Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
3. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
   Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
   Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
4. Embedding and First Coat: Job-mixed, drying-type taping compound.
   Fill (Second) Coat: Job-mixed, drying-type topping compound.
   Finish (Third) Coat; Job-mixed, drying-type topping compound.
5. Embedding and First Coat: Job-mixed, drying-type, all-purpose compound.
   Fill (Second) Coat: Job-mixed, drying-type, all-purpose compound.
   Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.
6. Embedding and First Coat: Setting-type compound.
   Fill (Second) Coat: Setting-type compound.
   Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

F. Where Level 3 gypsum board finish is indicated, apply join compounds specified for first and second coat in addition to embedding coat.
G. Where Level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.
H. Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
I. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and board manufacturer's directions for treatment of joints behind tile.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.
B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:

C. Samples: For each exposed finish.

D. Product test reports.

E. Maintenance data.

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   a. Identify materials with appropriate markings of applicable testing and inspecting agency.
2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

1.04 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable

for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   1. Size: Select wire diameter so its 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 0.106-inch- (2.69-mm-) diameter wire.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following: (to match material selected by the Architect and listed on the Index to finish Schedule on the drawings)

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Armstrong World Industries, Inc.
   2. BPB USA.
   3. Chicago Metallic Corporation
   4. Ecophon CertainTeed, Inc.
   5. Tectum Inc.
   6. USG Interiors, Inc.

C. Panels:
   1. For kitchen, laundry, and other spaces opening to either: Armstrong Ceramaguard, square edge 24" X 24".
   2. For other spaces: Armstrong Fine Fissured, angled Tegular White, 24" X 24".

2.03 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc.
   2. BPB USA.
   3. Chicago Metallic Corporation.
   4. Ecophon CertainTeed, Inc..
   5. USG Interiors, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with ASTM 636 and seismic design requirements indicated per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of ceiling. Avoid using less-than-half width panels at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Spray hangers only where required to miss obstructions; offset, resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs or to steel roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095113

SECTION 099000 - PAINTING

PART 1 – GENERAL

1.01 Description

A. Section Includes: All labor, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting and decorating work as indicated on Finish Schedules and to the full extent of the drawings and specifications.

B. The Work shall also include, but not necessarily be limited to surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, making good surfaces and areas, pre-treatment, priming and back-priming to the extent / limits defined under *MPI* preparation requirements.

C. No finish painting is required in Mechanical Rooms and Plenums.

1.02 Quality Assurance

A. This Contractor shall have a minimum of five (5) years proven satisfactory experience and shall maintain a qualified crew of painters throughout the duration of the work.

B. Only qualified journeypersons, as defined by local jurisdiction shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.

C. All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (*MPI*) (hereafter referred to as the *MPI* Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

D. All paint manufacturers and products used shall be as listed under the Approved Product List section of the *MPI* Painting Manual.

E. The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

1.03 Product Delivery, Storage, and Handling

A. Deliver and store all painting materials in sealed, original labeled containers bearing manufacturer’s name, brand name, type of paint or coating and color designation, standard compliance, materials content as well as mixing and/or reducing and application requirements in strict accordance with manufacturer and *MPI* requirements.

1.04 Environmental, Waste Management and Disposal Requirements

A. Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.

B. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

C. Ensure adequate continuous ventilation and sufficient heating and lighting is in place.
D. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.
E. To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.
F. Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

PART 2 – PRODUCTS

2.01 Materials
A. Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in the latest edition of the *MPI* Approved Product List (APL) are acceptable for use on this project. All such material shall be from a single manufacturer for each system used.
B. Other materials such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an *MPI* listed manufacturer and shall be compatible with paint materials being used as required.

2.02 Mixing and Tinting
A. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.

2.03 Finish, Color, Gloss / Sheen
A. Unless otherwise noted, all painting work shall be in accordance with *MPI* Premium Grade finish requirements.
B. Colors shall be as selected by the Consultant from a manufacturer’s full range of colors. Refer to Finish Schedule for identification and location of colors.
C. Gloss level ratings of all painted surfaces shall be as noted on Finish Schedule. Refer to *MPI* Painting Manual for gloss level definitions and requirements.

PART 3 – EXECUTION

3.01 Condition and Preparation of Surfaces
A. The condition and preparation requirements for all surfaces shall be in accordance with *MPI* Painting Manual requirements.

3.02 Application
A. Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.
B. Apply paint or stain in accordance with noted *MPI* finish Grade requirements.

C. Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations. Apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results.

3.03 Exterior Finish / Coating Systems: Paint exterior surfaces in accordance with the following *MPI* Painting Manual requirements:

A. Concrete Vertical Surfaces:
   1. EXT 3.1A Latex gloss level -3 finish (over alkali resistant primer).

B. Concrete Masonry Units:
   1. EXT 4.2A Latex gloss level -3 finish (over latex block filler).

C. Structural Steel and Metal Fabrications:
   1. EXT 5.1D Alkyd gloss level -5 finish (over alkyd primer) or primer applied by fabricator.

3.04 Interior Paint and Coating Systems: Paint interior surfaces in accordance with the following *MPI* Painting Manual requirements:

A. Concrete Vertical Surfaces: (including horizontal soffits and railings)
   1. INT 3.1A Latex gloss level -1 finish (over alkali-resistant primer).

B. Concrete Masonry Units: (smooth and split face block and brick)
   1. INT 4.2A Latex gloss level -3 finish.

C. Structural Steel and Metal Fabrications: (columns, beams, joists, metal doors and frames, etc.)
   1. INT 5.1A Quick dry enamel semi-gloss finish.

D. Galvanized Metal: (railings, misc. steel, pipes, overhead decking, ducts, etc.)
   1. INT 5.3A Latex gloss level -1 finish.

E. Plaster and Gypsum Board: (gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes)
   1. INT 9.2B High performance architectural latex eggshell finish.

3.05 Mechanical / Electrical Equipment and Related Surfaces

A. Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with color and texture to match adjacent surfaces, in the following areas:
   1. where exposed-to-view in all exterior and interior areas except Mechanical or Electrical rooms

B. In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks. Do not paint over nameplates.

C. Refer to Mechanical and Electrical specifications for painting, banding, stenciling of other surfaces / equipment.

3.06 Field Quality Control

A. Painted surfaces shall be considered to lack uniformity and soundness in accordance with defects noted in the *MPI* Painting Manual. Refer to long form specification item 3.7 - Field Quality Control / Standard of Acceptance.

B. Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor in accordance with *MPI* Painting Manual requirements.

3.07 Protection and Clean-Up

A. Protect all newly painted exterior surfaces from elements condensation and contamination until paint coatings are completely dry. Erect barriers or screens and post signs to warn of or limit or direct traffic.
B. Remove all spilled, splashed, splattered or over sprayed paint as work progresses, remove waste materials and keep area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

END OF SECTION 099000

SECTION 099600 - HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of painting work is shown on drawings and schedules (designated "GLAZED" or "WALL GLAZE") and as herein specified.

B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout project except as otherwise indicated. Surface preparation, priming and coats of paint specified are in addition to any shop priming and surface treatment specified under other sections of work.

C. The work includes preparation of surfaces for refinishing, and refinishing with coatings designated.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers and other applied materials whether used as prime, intermediate or finish coats.

E. Paint exposed surfaces whether or not colors are designated in "schedules" except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, Architect will select these from standard colors available for materials systems specified.

F. Following categories of work are not included as part of field applied finish work, or are included in other sections of these specifications:

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work and similar items. Also, for fabricated components such as architectural woodwork, wood casework and shop fabricated or factory built mechanical and electrical equipment or accessories.
2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory finishing or installer finishing is specified for such items as (but not limited to) prefinished doors, finished mechanical and electrical equipment including light fixtures and air diffusers, switchgear and distribution cabinets.
3. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operations, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise indicated.
    a. Do not paint over any code required labels such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.02 SUBMITTALS

A. Product Data
Submit manufacturer's technical information, including paint label analysis and application instructions, for each material proposed to use

B. Samples
Submit full range of standard color samples for Architect's review.

1.03 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label.

1.04 JOB CONDITIONS

A. Apply water base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F (7°C) and 95°F (34°C), unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if area and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Apply paint only with minimum 50 FC light provided at all surfaces.

E. Provide barriers to occupied portions of the facility during painting and curing operations.

F. At all interior applications, provide ventilation of at least 6 air changes per hour during painting and curing operations.

PART 2 - PRODUCT

2.01 COLORS AND FINISHES

A. Surface treatments and finishes are indicated in the Finish Schedule of the contract documents.

B. Prior to beginning work, Architect will make selection from manufacturer's complete range of colors for surfaces to be painted.

C. Color Pigments

1. Pure, non-fading, application types to suit substrates and service indicated.

a. Lead content in pigment, if any, is limited to contain not more than 0.6% lead as lead metal based on the total non-volatile(dry film) or paint by weight.

D. Paint Coordination

1. Provide finish coats which are compatible with prime paint used. Review other sections of these specifications in which prime paint are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information in characteristics of finish materials proposed for use, to ensure compatible prime coats are used.

2. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.02 MATERIAL QUALITY

A. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturer. Materials not displaying manufacturer's identification as a standard, best grade product will not be acceptable.

1. Proprietary names used to designate colors or materials are for the intended purpose of establishing a minimum standard of quality.

2. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Acceptable Manufacturers:

1. Tnemec Company, Inc., Kansas City, MO, (866-317-3206)

2. Sherwin Williams Co.
3. Architect-approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied, and notify Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and other conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

A. General

1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified for each particular substrate condition.
   a. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
   b. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.
   c. Wash all existing surfaces with solution of trisodium phosphate or equal cleaner, followed by a wash with clear water.

B. Cementitious Materials

1. Prepare cementitious surfaces of concrete and concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze.
2. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
3. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting. Follow manufacturer's preparation instructions for surfaces if different from above.

C. Ferrous Metals

1. Clean ferrous surfaces which are not galvanized or shop coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical clean.
   a. Touch-up shop applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

D. Galvanized Surfaces
1. Clean surfaces per ASTM D 6386-99 (2005) as a minimum. Follow manufacturer's written recommendations. Remove all passivators.

3.03 MATERIAL PREPARATION
A. Mix and prepare painting materials in accordance with manufacturer's directions.
B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Maintain limited storage quantities as acceptable to the Fire Department.
C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film, and if necessary, strain material before using.

3.04 APPLICATION
A. General
1. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
a. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, weld and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
b. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
c. Finish exterior doors on tops, bottoms and side edges same as exterior faces unless otherwise indicated.
d. Sand lightly between each succeeding enamel coat.
e. Omit first coat (primer) on metal surfaces which have been shop primed and touch-up painted unless otherwise indicated.
B. Scheduling Painting
1. Apply first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
a. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
C. Minimum Coating Thickness
1. Apply materials at not less than manufacturer's recommended spreading rate to establish a total dry film thickness as recommended by coating manufacturer.
D. Mechanical and Electrical Work
1. Painting of mechanical and electrical work is limited to those items exposed in occupied spaces.
E. Prime Coats
1. Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
a. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish

coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes
1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

3.05 CLEAN-UP AND PROTECTION
A. Clean-Up
1. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
a. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection
1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to Architect.
a. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.06 FINISH PAINTING SCHEDULE
A. The following finish systems refer to products of Tnemec Company, Inc., unless indicated otherwise.

1. CONCRETE AND CMU WALLS
(Epoxy/Polyurethane System)
Coat 1: Tnemec Series 130 Envirofill at 80 sq. ft. per gallon Coat 2: Tnemec Series 280 Tneme-Glaze at 8.0 mils DFT Coat 3: Tnemec Series 297 Enviro-Glaze at 2.5 mils DFT

2. CONCRETE FLOORS (carry finish 6” up wall to form base)

3. Coat 1: Tnemec Series 241at 75 sq.ft.per tilt broadcast t refusal at 1/16"

Coat 2: Tnemec Series 280 Tneme-Glaze at 12 mils DFT

4. Coat 3: Tnemec Series 248 CRU at 2.0-3.0 mils DFT

END OF SECTION 099600

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Private-use bathroom accessories.
   3. Under lavatory guards.
   4. Custodial accessories.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.
C. Maintenance data.
D. Warranty: Sample of special warranty.

1.03 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.

1.04 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
B. Toilet Tissue (Roll) Dispenser:
   1. Basis-of-Design Product: Bradley 50S4 single roll, surface mounted with top 19” above finish floor, ~~36” from back wall~~ *7” to 9” in front of water closet*.
   2. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
   3. Material and Finish: Stainless steel, No. 4 finish (satin) Chrome-plated zinc alloy (zamac) or steel.
C. Mirror Unit:
   1. Frame: Stainless-steel angle, 0.05 inch (1.3mm) thick.
      a. Corners: Manufacturer’s standard.

2. Integral Shelf: 5 inches (127mm) deep.
3. Hangers: Produce rigid, tamper-and theft-resistant installation, using method indicated below.
   a. One-piece, galvanized steel, wall-hanger device with spring action locking mechanism to hold mirror in position with no exposed screws or bolts.
4. Size: As indicated on Drawings.

2.02 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Plumberex Specialty Products, Inc.
   2. Truebro by IPS Corporation.

B. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded plastic, white.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 102813 - SECURITY ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install all security accessories as indicated on the drawings and as specified herein.

B. Security accessories located where indicated on the drawings, shall include but not be limited to:

1. Mirrors in inmate and isolation cells.
2. Grab Bars
3. Clothes Hooks.

1.02 SUBMITTALS

A. Submit shop drawings on each item listed above in a bound folder. These may be manufacturer's catalogue cuts; however, they shall include mounting details and hardware. Any templates required for fabrication of opening required to install equipment shall be included in the shop drawing submittal. When this booklet is submitted, it shall have a title cover listing job name, specification section name and number, Contractor's name, and date. Submit six copies for approval.

1.03 QUALITY ASSURANCE

A. Security accessories manufacturer shall have had a minimum of five (5) years experience in this type of work.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Wrap, label, crate, and protect finished items against damage in transit or on job.

1.05 ACCEPTABLE MANUFACTURERS

A. Northwest Specialty Hardware
B. Bradley
C. Chief Custom Products
D. Peerless

PART 2 - PRODUCTS

2.01 MIRRORS

A. Mirror plate shall be 20 gauge stainless steel polished to a No. 7 finish or chrome plated steel. Mirror shall be secured to wall with eight (8) Spanner head fasteners and appropriate anchors.

B. Mount the mirror on the wall centered above the lavatory at 5'-5", except 3’-4” finish floor to bottom of mirror surface at handicap lavatories.

C. Provide one (1) framed mirror in all inmate toilets above each lavatory. Bradley SA06 or equal

2.02 GRAB BARS

A. Fabricated of type 304 1-1/2” OD stainless steel tubing.

B. Furnish with torx-head mounting screws.

C. Sizes as indicated. Bradley SA70 or equal.

2.03 BOOKSHELF WITH CLOTHES HOOKS

A. Stainless steel shelf with clothes hooks, Bradley SA54 or equal.

2.04 INDIVIDUAL CLOTHES HOOK

A. Provide stainless steel security clothes hook, Bradley SA37 or equal.

2.05 FINISHING

A. All steel detention equipment herein specified, except stainless steel, chrome plated, and aluminum items, shall be shop finished with powder coat paint system.

2.06 SECURITY SCREWS

A. All security furniture, accessories, etc. located within any inmate area, corridors, dayrooms, cells, exercise yards, multipurpose rooms, visitation, kitchen, library, etc. shall have stainless steel torx head with center pin security screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the security accessories in accordance with the drawings and the manufacturer's written instructions. Exact location of items shall be as indicated. Installation shall be coordinated with the security hollow metal manufacturer and security glazing manufacturer.

END OF SECTION 102813

SECTION 104401

INSTITUTIONAL COVER SYSTEM FOR CONCEALMENT OF PIPING, CONDUIT, WIRING AND CABLE

PART 1 GENERAL

1.01 DESCRIPTION

A The soffit/cover system shall incorporate a concealed snap-lock assembly connection which, once assembled, renders the cover essentially irremovable with the use of ordinary tools.

1.02 SUBMITTALS

A Submit copies of manufacturer's specifications, installation instructions and product data.

1.03 JOB CONDITIONS

A Coordinate installation soffit/cover system with all other trades.

PART 2 PRODUCTS

2.01 MATERIAL

A A factory-fabricated steel cover support system with concealed surface-mounted attachment clamps, in dimensions as shown on the drawings for concealment of piping, conduit, wiring, cable or fire sprinkler piping.

Approved sources:

Grice Engineering, Inc.
121 East Burbank Avenue
P.O. Box 8037
Janesville, WI 53547-8037
Phone #: 800-800-3213
Fax #: 608 -757-1452

In-Ex Systems
4473 Cavallon Way
Acworth, GA 30101
Phone#: 800-483-8201
Fax#: 678-766-8202

B Support/Attachment Devices

1. Spring steel shield clips of the size recommended by manufacturer, for securement of the cover. Clips shall be produced from heavy-gauge zinc-plated spring steel. Each clip shall be demonstrated as being able to resist a force of 200 lbs. uplift at the free end. Test results shall be available upon request.

C Soffit/Cover

1. The soffit/cover shall be smooth in appearance and shall be made of 16-gauge steel with a paintgrip finish*, or in accordance with the material specifications as shown below. The cover shall have a snap-lock interfacing with the clips such that once assembled, it is rendered virtually irremovable with the use of ordinary tools.

2. The soffit and related fittings shall be factory painted with Sherwin Williams epoxy polyester hybrid powder coating of a color to be specified by the owner's representative. Matching touch-up paint shall be supplied to the owner by the manufacturer.

3. Cover manufacturer shall be staffed with a licensed engineer having a minimum of five years experience with such systems.

4. The cover shall be sized in accordance with requirements to accommodate the specific application size as specified by the project documents, specifications and blue prints, provided to the cover manufacturer prior to bid date.

5. L-Design and/or U-Design shield cover for sidewall and/or pendant installations respectively. U-shield is available with an optional 45 degree upward sloping top side to allow side wall attachment and prevent Soffi-Steel from being used as a shelf.

6. Cover joints shall be interlocking integral joints with provision for securement utilizing stainless steel rivets. Rivet spacing shall be at no greater than 2" intervals along the joint and positioned at a distance no greater than 1" from the end of the overlapping section.

7. Cover design shall include a rollformed "groove" at the interfacing of the cover and the adjacent construction surface to facilitate the application of sealant/adhesive compounds and enhance the security of such compounds from dislodging.

*NOTE TO SPECIFIERS: Other options are available.

Stainless steel with #4 finish: 16 Gauge, 18 Gauge, 20 Gauge

Cold-Rolled Steel: 16 Gauge, 18 Gauge, 20 Gauge

Finishes available with cold-rolled steel:

Zinc-galvanized Paintgrip (treated to accept painting but not painted) of ASTM-A527 Coating Class G90.

Zinc-galvanized Paintgrip, factory treated and factory painted in colors selected by architect from manufacturers standard colors. Special colors available upon request.

Primed with specific primer which will be compatible with paint scheduled after installation.

D Accessories

1. The system shall include tamper-resistant end caps, prefabricated corners, wall flanges, couplings, and other items which may be necessary to complete the system, and shall be installed in accordance with the manufacturer's recommendations.

2. Spare Parts - The installing contractor shall supply the owner with quantities of spare parts equal to a minimum of five percent (5%) of the total quantities of each Soffi-Steel system part utilized in this installation.

PART 3 EXECUTION

3.01 INSTALLATION

A Installation of system shall be in strict accordance with approved shop drawings and manufacturer's printed and video instructions.

1. If used to conceal fire sprinkler systems, the sprinkler contractor/engineer must determine the piping and sprinkler layout, including sprinkler head locations and pipe support locations (based on pipe manufacturer's specs.). Indicate areas on drawings where cover system is to be used.

2. Select appropriate fasteners for the substrate encountered to adequately secure the pipe and cover system.

3. To insure that the cover is linear and snug-fitting when installed, it is imperative that its support devices are anchored squarely and firmly in a straight line against the structural surface.

4. All penetrations to the soffit/cover system shall be field cut to prevent misalignment with intended protrusion. The exceptions to this are that access doors may be factory furnished and installed and perforations, if required, may be factory perforated.

5. Guidelines for installation of modular soffit/cover system shall be supplied by the manufacturer of said system and the installing contractor shall adhere to the manufacturer's guidelines. Such guidelines shall be supplied by manufacturer in the form of both written and video installation instructions.

6. Manufacturer shall, upon installer's request, supply on-site installation instruction by a qualified installation instructor for a minimum of one day for the project start-up (1,500 lineal feet minimum.)

7. The completed installation shall be visibly searched for voids between the interfacing of the cover and construction surface. Voids shall be sealed with the following security sealant: Ultra Polyurethane Sealant

END

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. 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. Amerex Corporation
b. Guardian Fire Equipment, Inc.
c. JL Industries, Inc.; a division of the Activar Construction Products Group
d. Larsens Manufacturing Company
e. Nystrom, Inc.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type A, B, C: UL-rated 10 LB nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 111920 - PRE-ENGINEERD STEEL DETENTION MODULES

PART 1 - GENERAL

Note: The supply and installation of Manufactured Steel Detention Modules shall be the responsibility of the Detention Equipment Contractor (DEC). The steel module manufacturer is providing material (modules) to the DEC at the job site only. The DEC is responsible for supplying, coordination of drawing submittal and equipment with other trades, scheduling, taking delivery, installation, and warranty of the modules in addition to any manufacturer's warranty.

1.1 SCOPE

This specification covers the requirements, including labor, materials, services, and equipment for the manufacturing, delivering, and installing of pre-engineered, prefabricated Steel Detention Module. Modules are defined as a factory built completely fabricated five, sided galvannealed or galvanized steel unitized assembly furnished, finished, equipped, and shipped to the project jobsite ready for immediate installation.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections, apply to the work of this section.

B. Other Section specified by related work include:

1) Section 033000 - Concrete. (Slab Quality)
2) Section 088853 - Security Glazing
3) Section 099123 - Finish Paint Module Fronts
4) Section 011900 - Detention Equipment Contractor
5) Section 021000 - Fire Suppression
6) Section 224600 - Security Plumbing Fixtures
7) Section 220000 - HVAC Systems
8) Section 260000 - Electrical Systems
9) Section 280500 - Security Electronics/Module Control System.

1.3 REFERENCES

The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced herein by basis designation only.

ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Testing Apparatus
ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM F33 Committee - Draft test method for steel Bunks, Seats, Tables used in detention facilities.
ASTM F2322-12- Test Methods for Physical Assaults on Fixed Barriers for Detention Facilities.
ASTM F2697-15; Physical Assault on Horizontal Fixed Barriers for Detention and Correctional Facilities.
ASTM F1450-12- Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities

ANSI/NAAMM HMMA 863 - Guide Specifications for Detention Security Hollow Metal Doors and Frames
ANSI/AWS D1.1 - Structural Welding Code-Steel
ANSI/AWS D1.3 - Structural Welding Code - Sheet Steel

1.4 DEFINITIONS

A. ANSI American National Standards Institute, Inc.
11 West 42nd Street
13th Floor
New York, NY 10036
Telephone: 212/642-4900 www.ansi.org

B. ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Telephone: 610/832-9585 www.astm.org

C. NAAMM National Association of Architectural Metal Manufacturers
800 Roosevelt Rd.
Bldg. C, Suite 312
Glen Ellyn, IL 60137
Telephone: 630/942-6591 www.naamm.org

1.5 SUMMARY

A. The Steel Detention Module Manufacturer (DMM) shall provide the following; And as indicated in PART 5 - DIVISION OF RESPONSIBILITY.

Factory Built Five-sided Cell Modules:

1) Security Doors and Frames
2) Security Glazing.
3) Embedded Electrical and Lighting
4) Preps for fire protection.
5) Plumbing Fixtures, and Accessories
6) Integral HVAC Grilles and duct connection flanges
7) Factory installed Furnishings and Accessories
8) High performance interior coatings and exterior primers.

1.6 BASIS OF DESIGN

SteelCell of North America, Inc. - Baldwin, Georgia

1. 7 PREQUALIFICATIONS

A. All prospective DMMs shall submit all information exactly as indicated prior to award or they will not be prequalified to bid and supply the products specified in this Section of the specifications.

B. The Architect will promptly review DMM Qualification Data to determine the acceptability of each prospective DMM. Those found acceptable will be named subsequently by

C. addendum as prequalified to bid and supply the products specified in this Section of the specifications. Verbal approval will not satisfy this requirement.

C. Owner and Architect reserve the right to disqualify DMMs who do not strictly comply with requirements of this Section. Grounds for disqualification shall exist if it is determined that the information submitted is incomplete, inaccurate, not submitted exactly as indicated, or in the opinion of the Architect, does not satisfy the prequalification requirements. The decision of the Architect in this matter shall be final. The substitution of non-prequalified manufacturers will not be allowed.

D. Required Qualification Data:

1. Documentary evidence that the DMM has a minimum of ten (10) years' experience in the fabrication of steel detention cell modules.
2. A list of a list of twenty (20) projects that have been complete and operational for a minimum of ten (10) years where DMM's cell modules are used. Provide the following information for each facility:
    a. Name and location of the facility.
    b. Value of the contract and scope of work performed.
    c. Date of occupancy by the Owner.
    d. Names and phone numbers of the representatives to contact for the Owner, the Construction Manager or General Contractor and the Architect.
3. To prevent the likelihood of deterioration or rust, the manufacturer must certify that the cell modules will be manufactured entirely of galvannealed or galvanized steel. DMM must submit mill certifications as proof.
4. The names and contact information for the Architect, Engineer, and Owner on all projects where DMM has supplied prefabricated steel detention cell modules within the last ten (10 years.
5. A notarized statement from the DMM listing the bill of materials that will be used for this project. No exceptions to this bill of materials shall be accepted after the awarding of the contract. Multiple selections are not acceptable. In addition, DMM also must state that it will supply the products as shown in the drawings and will not submit a substitute/alternate design. Furthermore, state in writing, your intent to "comply fully with the requirements of this specification and drawings and to hold harmless the Architect, Engineer, and the Owner from omissions of a casual nature that would be considered to be an implied requirement for a fully operational modular cell system." Provide a list of compliance to and non-compliance for each section of this Specification. Compliance/Non-compliance must be a formal listing of each section and subsection of this Specification and an explanation of compliance/non-compliance for each section and subsection.
6. A list of all outstanding or past judgments or lawsuits against the company Owners under their current name, or any previous name or business entity.
7. Design Engineering Capability: DMM must have current design engineering capability to provide the final engineered structural design for modular steel cells and associated items and their integration into the building construction.
    a. Submit a list of design engineering staff giving name, discipline, degree and registrations or licenses, number of years modular steel cell experience, years with the company and title or position.
    b. Submit a list of technical support personnel for design engineering.
    c. Submit samples of design engineering systems (or samples of previous projects) either in AutoCad, or other equivalent engineering programs, to determine engineering capability.
8. In-House Production Management Capability: DMM must have current, in-house production management capability with at least ten (10) years of modular steel cell experience, capable of understanding design engineering documentation and managing the fabrication process to

produce the modular steel cells as engineered.

a. Submit a list of key in-house production management staff giving name, credentials, number of years' experience, years with company, and title.

9. Production Capacity:
   a. DMM must have the production capacity and resources to produce the required number of units within duration of production that is compatible with the construction schedule.
   b. Submit name, location, historic production rate and annual production capacity of the plant, and the total number of units produced and in the field.
   c. Submit the estimated quantity of work under contract and either scheduled or anticipated for the production facilities proposed for the time period of this project. List by project and estimated production dates.
10. Product Performance Characteristics:
   a. Impact resistance: Third party certification (stamped by performing third party engineer) of test results for compliance with the following:
   b. ASTM F2322-12, Standard Test Methods for Physical Assault on Vertical Fixed Barriers for Detention and Correctional Facilities
   c. ASTM F2697-15; Physical Assult on Horizontal Fixed Barriers for Detention and Correctional Facilities.
   d Provide testing in compliance with ASTM F-33 draft test for impact and static load testing of detention module furniture.
      - Wall mounted module bunk.
      - Wall mounted module desk.
      - Wall mounted module seat.
   e. ASTM F1450-12a, Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention Facilities
   f. Paint Performance: Submit testing reports of coating system that complies with the performance requirements as outlined in Article 2.11, Finish. Product data sheets will not be considered acceptable.
      1) Adhesion to prepared galvannealed steel: ASTM D4541-09e1, 850 PSI.
      2) Tensile Strength: ASTM D638-10, 3000 PSI.
      3) Elongation: ASTM D638-10, 425%.
      4) Hardness: ASTM D2240 - 05(2010), Shore D-51.
      5) Tear Strength: ASTM D624 - 00(2012), 450-580 PLI.
      6) Abrasion Resistance: ASTM D4060-10, 1000g, 1000 cycles CS-17: 6 mg loss.
      7) Accelerated Weathering: ASTM G154-12a, 3,000 Hrs.
      8) Gardner Impact: ASTM D2794-93(2010), 160 in./lb.
      9) Salt Fog Resistance: ASTM B117-11, 3,000 Hrs.
         - To confirm experience the DMM must submit a list of at least ten (10) other similar projects in the last five (5) years using this coating system.
         - DMM shall submit testing data to confirm compliance with the performance characteristics noted herein.
         - DMM shall submit sample coated wall section for review and testing.
   g. Seismic Performance: Cell modules shall safely withstand an acceleration, *Ss*, equal to 300% of gravity. Submit engineering calculations to confirm that cell modules meet this requirement.
   h. Quality Control: The DMM shall engage a Georgia state approved third-party inspection service to inspect the modular cells. The DMM shall submit a letter from the third-party code inspection company stating that the inspection company has been retained by the DMM to review cell fabrication documentation before, and inspect the cells during, cell

manufacturing for code compliance and quality control. DMM shall be approved by the state of Georgia to provide modular units to projects in Georgia

i Minimum HVAC Security Grille Testing:
   1) The CFM for 10" round security HVAC grilles shall meet the following minimums:
      a) Exhaust CFM shall be a minimum of 300 with a static pressure of 0.03.
      b) Supply shall be a minimum of 280 with a static pressure of 0.24.
   2) The DMM shall submit testing report by an AABC or NEBB certified testing engineer confirming that DMM security grilles meet these minimum requirements.

j. DMM shall submit testing from a certified acoustical laboratory regarding STC ratings.
   1) Cell-to-cell STC rating shall be no less than 53.
   2) Testing shall be conducted on material equal to the thermal/acoustical material noted in section 2.10 of this specification

1.8 SUBMITTALS

A. Product data and instructions for manufactured materials and products. Include Manufacturers' certifications and independent laboratory test reports as required.
B. Submittal drawings prepared showing complete design information for fabrication and installation of Steel Detention Module units. Indicate module dimensions, cross-section, elevations, material specifications, and installation details. Coordinate shop drawings with other trades to ensure compatibility of required service connections.
C. The maximum dead loads of the modular steel modules, including all equipment, shall not exceed the maximum allowance for the slab or building assembly on which the modules are anchored.
D. Submit drawings of recommended bearing pads and/or special anchoring devices.
E. Provide shipping, lifting, and handling diagrams indicating point loads and net and gross loads.
F. Provide catalog data with full performance criteria and dimensions for specified components purchased from outside sources.
G. Submittal Information
   1. Name of DMM.
   2. Name and location of project.
   3. Name of Architect, CM/GC and DEC
   4. Project number
   5. Governing codes of State Modular program
   6. Building design loads.
   7. Cell coatings or primers.

1.9 CLOSEOUT DOCUMENTS

A. Maintenance Data: O & M Manual for maintenance of the modular units and equipment.

PART 2 - PRODUCTS

2.1 ENGINEERING AND DESIGN

After all approvals the DMM shall provide Professional certification to the architect for the design of the Steel Detention Modules to support superimposed dead loads, live loads as indicated on the contract drawings and the specifications herein. The DMM shall certify the design for compliance with applicable governing code and local seismic requirements.

The design shall include integration of Steel Detention Modules into the physical floor plan,

sections, elevations, and structural design of the facility and shall assure that all systems specified in the contract documents are interfaced completely with Steel Detention Modules for a fully installed, fully working facility.

2.2 WORKMANSHIP

A. All units shall be tightly fitted and securely fastened with no through seams or cracks.
B. All panels and assemblies shall be inspected for correct dimensions, joint configuration, straightness, plumb and square.
C. All exposed edges shall be chamfered or bent for finger contact.
D. Out-to-out length, width and height dimensions of individual module units shall be a tolerance of +/- 1/4 in. (6.4mm). The cumulative tolerance in any direction shall not exceed the available horizontal or vertical dimension for the entire assembly of module units. Module suppliers shall inform the Architect prior to construction, of any dimensional conflicts which may adversely affect the installation of modules.
E. All panel joints, ceiling joints, and module corner joints exceeding 1/16 in. (1.6mm) wide and 1/8 in. (3.2mm) deep shall be filled with high strength epoxy caulk appropriate to application in Detention Environments.
F. Joints to be welded shall be cleaned and prepared as necessary to assure quality welding.
G. Welding shall be controlled and sequenced to reduce warpage and distortion.
H. All welds shall be free of deleterious porosity, pinholes, and cracks.
I. Finished welds shall be smooth with weld spatter and flux removed.

2.3 MODULE WALL CONSTRUCTION & STRUCTURAL COMPONENTS

A. Framing, floors, walls, and ceilings as required, shall be constructed of galvanneal steel, galvanneal steel shapes and tubing, conforming to design requirements noted herein to provide adequate structural strength including the ability to support loading as specified.
B. All walls and ceiling face panels shall be 0.100 in. (12 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-CS requirements. All structural or stiffening members shall be 0.058 in. (16 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-LFQ requirements. All structural tubing shall be 0.115 in. (11 gage) minimum thickness steel conforming to ASTM A 653-CS and ASTM A-525, G-90 galvanized requirements. No substitutions.
C. All welders shall be certified to, and all welding shall be in conformance with, the ANSI/AWS D1.1, Structural Welding Code - Steel and/or ANSI/AWS D1.3, Structural Welding Code - Sheet Steel, as applicable.
D. Tamper resistant fasteners shall be used for all exposed fasteners where required for accessories.
E. Mounting and bearing pads, anchorage’s, shims, or spacers, shall be manufactured of stainless steel.
F. Smoke Rated Steel Units: Where units are shown or scheduled as requiring smoke rated classification, provide units of design or assemblies tested in accordance with applicable building code approved assemblies or construction materials.

2.4 MODULE MEZZANINE LEVEL FLOOR & SECURITY CEILINGS.

A. Framing for lower and mezzanine level module ceiling as required, shall be constructed of galvanneal steel, steel shapes and tubing, conforming to design requirements noted herein to provide adequate structural strength including the ability to support dead and live loading as specified including the support of the mezzanine level walkway.
C. All floor face panels shall be 0.140 in. (10 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-CS requirements. All structural or stiffening members shall be 0.058 in. (16 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-

LFQ requirements. No substitutions.

D. All ceiling face panels shall be 0.100 in. (12 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-CS requirements. All structural or stiffening members shall be 0.058 in. (16 gage) minimum thickness A-60 galvannealed steel conforming to ASTM A 653-LFQ requirements. No substitutions.
E. Embedded electrical boxes and conduit for module electrical devices and electronics shall be concealed within the ceiling/floor structure routed from the device to the mechanical chase.
F. All cavities or voids shall be acoustically insulated with the relevant materials noted herein.

2.5 DOORS & DOOR FRAMES.

A. All door, door fame, and window construction shall be in accordance with ANSI/NAAMM HMMA 863-04.

All module doors: Face sheets shall be 0.093 in. (12 gauge) minimum thickness conforming to ASTM A653/A653M (A60, / Z180) steel. No substitutions.

B. All doors must satisfy the same performance requirements in accordance with ASTM F1450-12, Grade #1.
C. Glass and Glazing: Refer to the door schedule and the glazing section of these specifications.
D. Doors shall be pre-installed by the DMM, with all final adjustments completed by the module installer.

2.6 ELECTRICAL

The DMM shall provide the light fixture for each type of Steel Detention Module.

A. Light Fixture:
   The light fixture shall be equal to a Kenall SDSA-4-1/1-45L50K-120-1/9-1-DLN with two LED light strips and one (1) LED night light with light level control and shall be surface mounted type. The housing shall be 14-gauge steel. The frame shall be 14 gauge with 0.250 polycarbonate and 0.125 prismatic acrylic overlay. The finish shall be baked-on white enamel. All fixtures will provide a minimum of 20-foot candles of light at the desk and the mirror per ACA standards.
B. As needed the DMM shall submit photometric's to confirm placement of light fixtures and the correct lumens at the specified locations as per ACA standards.
C. The DMM shall caulk any cracks and or joints between the light fixture and the ceiling with a tamper resistant caulk to prevent contraband concealment.
D. The DMM shall provide a wiring pig tail or whip from the module light to a junction box at the module mechanical chase.
E. The DMM shall provide conduit terminated at a junction box on the mechanical chase wall for all module electrical equipment.
F. The DMM shall provide pull tape in all conduits that are not pre-wired.
G. The division 16000 contractor shall make all permanent connections from the termination point at the module mechanical chase.
H. All security hardware,shall be supplied and installed by others. This includes but is not limited to:
   1) Module Door and Pass Locks or Slider Devices.
   2) Module Door Position Switches.
   3) Door pulls.

2.7 PLUMBING

The DMM shall provide and install the plumbing fixtures and valve mounting plates for the Module Modules and Shower Unit and Lavatory/Toilet Combination Unit Modules. The DMM shall caulk

any cracks and or joints between the fixtures and the walls with a tamper resistant caulk to prevent contraband concealment.

A. Lavatory/Toilet Combination Unit: See plumbing schedule and Section 224600.
B. Handicap Lavatory/Toilet Combination Unit: See plumbing schedule and section 224600
    1) 42" Horizontal wall mounted grab bar with anti-suicide plate.
    2) Toilet paper holder shall be recessed wall mounted.
C. Shower Unit: Unit shall be Willoughby WSH-7D-SB3030-PT, or equal. Unit shall consist of a ceiling-mounted all stainless-steel showerhead, pneumatic metering single temperature valve and stainless-steel pushbuttons and escutcheon, and 30” x 30” shower-base with integral p-trap.
D. Handicap Shower Unit: Unit shall be Willoughby WSH-7D, or equal. Unit shall consist of a ceiling-mounted all stainless-steel showerhead, pneumatic metering single temperature valve and stainless-steel pushbuttons and escutcheon and a wall mounted accessible showerhead. To facilitate access, a sloped floor and drain shall be supplied by others.
    1) Wall mounted 32" x 18" L-shape grab bar with anti-suicide plate.
    2) Wall mounted collapsible handicap seat equal to Willoughby FCC HC
F. The flush valves, water control manifolds, p-traps and other plumbing accessories for the plumbing fixtures shall be provided by the DMM separately and installed by the Division 15 Contractor.
    1) The Section 22 Contractor is responsible for installing devices per the manufacturer’s installation instructions.
    2) The Section 22 Contractor is responsible for startup and any all required adjustments.
    3) The DMM shall provide a voucher from the fixture supplier to the plumber for all plumbing controls and devices.
    4) The plumber shall send the voucher to the plumbing supplier, which will send all specified devices to the project site to the plumber to receive.
G. The DCM shall provide the shower curtains for the shower stalls in the Cell Modules.
    1) The shower curtain shall be equal to the Secure Shower Curtain System as manufactured by *Derby Industries*.
    2) The shower curtain shall be suicide resistant with attachment via Velcro tabs.
    3) The shower curtain shall be flame and mildew resistant, anti-bacterial.

2.8 HVAC

A. Each Steel Detention Module shall be designed, manufactured, and equipped to receive the required HVAC fixtures specified in other divisions of this specification.
B. The DMM shall provide the HVAC grilles. The supply and exhaust security grilles shall be integral pre-punched into the wall panel in compliance with the specified Mechanical CFM requirements. A flange suitable for the attachment of the HVAC duct shall also be provided.
C. The Section 23 HVAC contractor shall provide suitable materials to connect duct to flange.
D. Security grills shall with 3/16" diameter holes on 9/32" staggered centers. Exhaust CFM shall be a minimum of 300 with a static pressure of 0.03. Supply shall be a minimum of 280 with a static pressure of 0.24.
E. HVAC Security Grille Testing:
    The CFM for the DMM's security HVAC grilles shall meet the following minimums considering 10" round grilles:
    1) Exhaust CFM shall be a minimum of 300 with a static pressure of 0.03.
    2) Supply shall be a minimum of 280 with a static pressure of 0.24.
    3) The DMM shall submit testing report by an AABC or NEBB certified testing engineer confirming that DMM security grilles meet these minimum requirements.

2.9 THERMAL AND ACOUSTICAL INSULATION

A. Insulation Material: Materials shall be approved by applicable IBC codes and governing authorities and in compliance with the manufacture's application procedures and recommendations including the application of compatible thermal barriers.
    1) All exposed insulation shall be a closed cell polyurethane foam equal to NCFI 11-24.
B. Foam shall meet ASTM E-84 FS≤25, SD ≤ 450 at 2 inches thickness.
C. All cavity type insulation shall be open cell polyurethane foam equal to NCFI 23-010.
D. Foam shall meet ASTM E-84 FS≤25, SD ≤ 450 at 2 inches thickness.
E. Thermal Insulation: Walls, floors, and ceilings shall be insulated to R-values as follows:
    1) Interior Walls: R14 minimum.
    2) Exterior Walls: R14 minimum.
    3) Floor and Ceiling: R8.
F. Acoustical Insulation: The walls and floors between modules and adjacent modules shall have a Sound Transmission Classification (STC) of 53. Module Fronts shall have a STC of 35. Back of modules to rear mechanical chase and front chase walls to mechanical chase shall have a STC of 40.

2.10 FURNISHINGS, AND ACCESSORIES

A. Steel Detention Module Furniture: Where shown on the contract drawings as module furniture to be so provided, the DMM shall provide and install wall mounted bunks, tables and stools. Bunks, tables, and stools shall fabricate of ASTM 653 steel ASTM 525 grade A60 galvannealed, 0.106 in. (2.7mm) minimum thickness and of the sizes shown. DMM shall include drawings which detail materials, construction, and attachment. These drawings shall be a part of the submittals as outlined in Section 1.8 herein. Fabrication of these items shall not begin prior to the Architect's approval.
B. Fixtures, Furnishings and Accessories Load Test: Reinforce walls, stiffen furnishings, and provide connections as required to support dead loads plus single point (concentrated) static live loads as indicated, at maximum distance on each from wall and from supports for each of the following in accordance with the ASTM draft standard test method for wall mounted steel bunks, seats, and tables used in detention and correctional facilities.
    1) Top impact test.
    2) Static force test.
    3) Cantilever load test.
    4) Uplift load test.
    5) Wall mounted lavatory - 1000 lbf (4.45 kN)
C. All furniture and equipment shall be designed and installed so as to be flush to the modular walls that leaves no seams or voids for the concealment of contraband. Thus, there shall be no cracks, seams or voids that can be exploited by the inmates to conceal contraband.
    This includes all seams at cell security equipment including but limited to the following:
    1) One-piece stainless-steel mirror.
    2) Anti-ligature clothes hook strips.
    3) Detention light fixture.
    4) Penal plumbing fixtures.
    5) Desks and seats
D. All seams at equipment noted above that do not comply with ACA standards shall be filled with a pick resistance caulk.

2.11 AUTOMATIC FIRE PROTECTION SYSTEMS

A. The DMM shall provide a prepared location for the installation of the sprinkler head by the fire protection contractor.

B. The DMM and fire protection contractor shall coordinate to confirm the type and location of the

sprinkler head to ensure the proper interface of work.

2.12 FINISH

A. Prior to application of coatings, all surfaces shall be cleaned and prepared in accordance with SSPC-SP1, SP6, or SP7 as required or as specified by the coating manufacturer.

B. All interior steel surfaces of the Steel Detention Module shall be prime coated with a Sherwin Williams Envirolastic AR425 Polyurea Elastomer 26 to 36 mils dft. The coating shall be certified to ASTM E84, Class II for surface burning characteristics and shall meet or exceed the following

1)	Adhesion:	ASTM D-4541	850 PSI.
2)	Tensile Strength:	ASTM D-638	3000 PSI.
3)	Elongation:	ASTM D-638	425%.
4)	Hardness:	ASTM D-2240	Shore D-51.
5)	Tear Strength:	ASTM D-624	495 PLI
6)	Abrasion Resistance:	ASTM 4060,	1000g,1000 cycles CS-17: 6 mg loss.
7)	Accelerated Weathering:	ASTM G-53	3,000 Hrs.
8)	Gardner Impact:	ASTM 2794	160 in. lbs.
9)	Salt Fog Resistance:	ASTM B117-90	3,000 Hrs.

C. All module interior steel surfaces shall be finish coated with Sherwin Williams FastClad DTM urethane for UV protection, 3 to 4 mils dft, and shall meet or exceed the following:

1)	Abrasion Resistance:	ASTM D4060	90 mg loss
2)	Adhesion:	ASTM D4541	825 psi
3)	Corrosion Weathering;	ASTM D5894	15 cycles
		ASTM D714	10 rating
		ASTM D610	10 rating
4)	Flexibility:	ASTM D522	Passes
5)	Salt Fog Resistance:	ASTM B117	3,000 hours

D. The exterior of the module fronts and module door along with the cover plates shall be prime painted only with a Catalyzed Epoxy 3 to 4 mils dft, and shall meet or exceed the following:

1)	Adhesion:	ASTM D4541	500 psi
2)	Corrosion Weathering:	ASTM D5894	3360 hours
3)	Direct Impact Resistance:	ASTM D2794	>140 in. lbs
4)	Moisture Condensation:	ASTM D4585	100 F, 1250 hrs
5)	Salt Fog Resistance:	ASTM B117	1250hrs, Passes

E. The finish paint of the module front and both sides of module door shall be by the others.

F. Steel Detention Modules shall be of a single color as selected by the Owner from samples submitted by the manufacturer. Available color shall be included with module product data Submittals.

2. 13 MEZZANINE WALKWAY, RAILINGS AND STAIRS.

1. Mezzanine level walkways, hand-railings, and stairs shall be constructed, finish painted, and installed by others.

2. DMM and fabricator/installer shall coordinate thru the DEC to ensure proper interface of work.

PART 3 - DELIVERY AND INSTALLATION

3.1 DELIVERY SEQUENCING AND SCHEDULING

A The DEC and DMM shall coordinate the scheduling and sequencing of the module delivery to the project site. A mutually approved schedule shall be determined by the DEC and DMM at the pre-construction meeting. The sequencing of the module units shall conform to this schedule to properly interface the delivery and installation of modules at the proper time during the construction period.

B. DMM shall deliver Steel Detention Modules to the designated project site, properly protected from shipping damage as needed. The DEC and General Contractor shall provide suitable protective coverings, devices or such methods and procedures to protect the modules from damage from the weather, other trades, and vandalism. Protective measures shall remain throughout the construction period. Unloading and handling of the module units shall be the responsibility of the module installer. Final module door adjustments shall be completed by the installer.

3.2 SITE INSPECTION

The installer of the Steel Detention Modules shall examine areas and conditions under which the units are to be installed. The installer is to notify the contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.3 INSTALLATION

A. The DEC shall provide the DMM a proposed schedule of module delivery and installation sequence before the project bid date in order for the DMM to properly bid the installation of the modules.

B. The DEC shall be a pre-qualified factory trained and certified module installer to install the Steel Detention Modules. The DMM shall provide as needed a qualified on-site representative for initial module installation to verify proper module offloading and installation procedures.

C. The DEC and General Contractor shall provide adequate access for the DMM's tractor-trailer transport trucks and the module installer's installation equipment. This access shall be suitable for the DMM's trucks, and the module installer's equipment to maneuver under their own power.

D. The DEC and General Contractor shall provide adequate space and maneuvering room to install the modules. There shall be no barriers or work of others that restrict or prevent the adequate movement of the modules or the installer's installation equipment.

E. Steel Detention Modules shall be set in place by the module installer and shall be checked for correct alignment and level. Shims shall be installed as necessary and securely fastened to the foundation. Complete all connections, trim and touch up, meeting the acceptable industry standards and the DMM's installation instructions.

F. The DEC shall install trim plates as provided by the DMM per the installation instructions to cover the joint between the modules. All other joints are to be trimmed or caulked by others.

G. Fill all voids between the bottom of the module's walls and the floor with security caulk. This shall be completed by others.

PART 4 - WARRANTY

The DMM shall provide a signed warranty agreeing to repair defective materials and workmanship of the Steel Detention Module. The module warranty shall be conditional upon normal use of the modules. Abuse, such as riots are not considered normal use. The Warranty shall be for a period of one (1) year after substantial completion.

PART 5 - DIVISION OF RESPONSIBILITY

5.1 BY THE DMM

A. Engineer, design, fabricate, transport deliver for erection by the DEC prefabricated steel detention modules as required for a complete installation. Provide module specific products, system components of other related sections for a complete functionally operational module.
B. Provide for any structural components needed for support of work including support for the mezzanine walkway.
C. For those units with slider doors provide cased opening prepped to receive sliding door device, locking and receiver columns.
D. For those units with swinging doors provide security hollow-metal framed opening and security door prepped for the specified security hardware and electronic devices.
E. Provide high build high performance seamless coating system for all interior surfaces and coated components.
F. Provide wall mounted detention furnishings as specified, welded in place and coated for a seamless finish.
    1) Furnishings shall be statically and dynamically tested to ASTM standards as specified.
G. Provide suicide resistant equipment and accessories as specified, secured with tamper resistant fasteners and security caulked as necessary to prevent the concealment of contraband.
H. Provide stainless steel plumbing fixtures and grab-bars as specified, secured with tamper resistant fasteners and security caulked as necessary to prevent the concealment of contraband.
    1) Provide control valves and accessories as specified for field installation by others.
I. Provide electrical conduit, boxes, and fittings for the light fixtures as specified.
    1) The light fixture shall be secured in place and security caulked.
    2) Provide a wiring whip from the light to the pull box at the mechanical chase.
J. Provide electrical conduit, boxes and fittings for security electronics and locks.
    1) Provide pull tape from the prep to the pull box at the mechanical chase.
K. Security caulk at the crack between the bottom of the module and slab on grade shall be supplied and installed by others.
L. Provide a prep for the sprinkler head that will be supplied and installed by others.
M. All modules shall be inspected by approved third party inspection company for code and quality compliance.
N. Provide module to module and module to adjacent wall cover-plates to cover open cracks or joints.
O. Mezzanine walkway, handrails, and stairs assemblies by others.

END OF SECTION 111920

SECTION 125500 - SECURITY FURNITURE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install all detention furniture and mounting hardware as indicated on the drawings or specified herein.

B. Position furniture as indicated on the drawings.

C. Furniture shall include but not be limited to the following:

1. Cell bunks
2. Dayroom tables
3. Stool
4. Shower partitions
5. Control room pedestals

1.02 SUBMITTALS

A. Submittals shall be bound in an enclosure with a label on the front listing the job name, specification section and name, Contractor name, and date. This submittal shall contain Catalogue cuts, drawings showing dimensions of mounting items, critical information such as metal kind and thickness, finish, method of construction, overall dimensions, et cetera.

1.03 QUALITY ASSURANCE

A. The detention furniture manufacturer shall have a minimum of five (5) years experience in this type of work.

B. The detention furniture shall be manufactured by:

1. *American Jail Products*
2. *Georgia Correctional Industries*
3. *Sweger Metal Fabricators*
4. *Viking Products, Orange, CA*
5. *Majestic Solutions, Madison, AL*
6. *Proform, Winnsboro, TX*

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Furniture, mounting hardware, and mounting instructions shall be shipped together.

B. Furniture shall be protected while on the job to insure there is no deterioration or damage until installed.

PART 2 - PRODUCTS

2.01 BUNKS

A. Bunks shall be size indicated on drawings. Bunks shall be floor mounted. See Architectural drawings for location. All bunks indicated shall be single or double as indicated.

2.04 TABLES

A. Furnish and install dayroom tables where shown on drawings to seat 6 and 8 persons as indicated. The top of the table and seat surface shall be stainless steel. The frame work shall be made of heavy square and rectangular tubing

and anchored to the floor with 5/8" non-removable fasteners.

2.05 CONTROL ROOM PEDESTALS

A. Control room pedestals shall be fabricated from steel sheets and shapes as indicated.

2.07 FINISHING

A. All steel detention equipment specified herein, except stainless steel, chrome plated, galvanized and aluminum items, shall be factory finished painted by powder coat process.

B. Detention Equipment Contractor to submit standard color chart to Architect for selection of finish paint. Provide touch-up paint matching color for use on job.

PART 3 - EXECUTION

3.01 INSTALLATION

A. When installed, all items shall be level and plumb.

A. Touch up all scratched surfaces after installation.

B. All furniture shall be anchored in a secure manner using non-removable fasteners. Plastic anchors are not acceptable, only metal. ALL SHARP EDGES SHALL BE GROUND SMOOTH. MOUNT ALL ITEM IN ACCORDANCE WITH MANUFACTURES INSTRUCTIONS. All fasteners shall be stainless steel torx head security screws.

END OF SECTION 125500

SECTION 133419 - PRE-ENGINEERED METAL BUILDING

PART 1 - GENERAL

1.01 SUMMARY

A. Work includes:

1. Providing Pre-Engineered Metal Building complete including rigid frames and other framing members, roof and wall panels, liner panels, purlins, girts, and other subframing members, vapor barrier and insulation, flashings, trim, louvers, and miscellaneous accessories.
2. Providing metal roofing, wall panels, soffit panels and accessories for installation with traditional building systems.
3. Metal doors and frames, windows, and overhead rolling door are specified in other sections.

1.02 REFERENCES

A. 2021 South Carolina Building Code.

B. Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design, August 1, 2022, and the Commentary on the AISC Specification, August 1, 2022, and the Code of Standard Practice for Steel Buildings and Bridges, May 9, 2022, as specified in the AISC Manual of Steel Construction, 9th edition, unless shown otherwise on the drawings or specified otherwise herein; or, AISC - Load and Resistance Factor Design Specification for Structural Steel Buildings and commentary First Edition 1986; and, Code of Standard Practice and Commentary, 1986.

C. American Welding Society, AWS D1.1 - Structural Welding Code, 2000 edition.

D. AISI - Specification for the Design of Cold-Formed Steel Structural Members, 1986.

E. MBMA - Low Rise Building Systems Manual, 2018

1.03 SYSTEM DESCRIPTION

A. Building components to withstand Building Dead Loads, Collateral Loads, Floor and Roof Live Loads, Roof Snow Loads, and Wind Loads due to pressure and suction of wind calculated in accordance with Georgia Building Code, latest Edition.

1. Building Dead Load - Actual Loads.
2. Roof Live Load - 20 psf - Reducible
3. Wind Load - See plans.
4. Seismic Load - See plans.
5. Collateral Loads:
   a) Mechanical and Electrical systems - 4 psf min.
   b) Ceilings and Architectural features - 4 psf min.
   c) Special concentrated loads - Actual loads of equipment furnished, See plans.

B. Deflection: Deflection of members when subjected to the applicable Design Loads and Collateral Loads specified shall not exceed the limits specified below:

1. Girts - L/120 of span.
2. Purlins - L/180 of span.
3. Frames (vertical loads) - L/180 of span.
4. Frames (lateral loads) - L/360 of eave height.
5. Lateral Building Drift - Match Frame Drift

C. Assembly shall permit movement of components without buckling, failure of

joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of -20° to +120° F. Provide sliding roof panel clips.

D. Pre-Engineered Metal Building Components shall be of type indicated on Drawings, and shall be provided by one manufacturer. Framing 3/16" thick and thicker shall conform to AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Framing less than 3/16" thick shall conform to AISI Specification for the Design of Cold-Formed Steel Structural Members.

E. Criteria and framing indicated in the specifications and on the drawings shall be considered a minimum standard. The pre-engineered metal building manufacturer shall add additional members or requirements in order to produce a complete pre-engineered metal building roof and wall system that meets or exceeds the code requirements and the requirements of this specification.

1.04 SUBMITTALS

A. Manufacturers Catalog Data or other descriptive data of miscellaneous accessories, fasteners, joint sealing material; including printed installation instructions and details; and factory color protective coatings.

B. Submit six (6) copies of approval drawings of structural steel, roof and wall covering, flashing, trim, closures, and methods of thermal expansion control, to be checked and approved prior to proceeding with fabrication.

C. Indicate building dimensions, general construction details, anchorages and method of anchorage, and method of installation, including framing, anchor bolt settings, sizes, and locations from datum.

D. Submit shop drawings with structural calculations justifying design under seal of a professional structural engineer registered in the State of South Carolina. Submittal shall include frame, column and bracing reaction diagrams for all load cases and load combinations.

E. Welding of all steel in field shall be done by certified welders qualified in accordance with "Qualification of Welding Procedure - Welders and Welding Operators" of the AWS Code of Welding in Building Construction (AWS D1.0). Submit letter indicating current qualification (within past 12 months) for each welder.

F. Submit Test Reports of all tests required by referenced publications applicable to the particular item or material furnished for use.

G. Warranty:
   1. Weathertightness.
   2. Panel Finish.

1.05 QUALITY ASSURANCE

A. Components shall be the design of a manufacturer regularly engaged in the fabrication of pre-engineered structures. All materials shall be new, unused, and free from defect.

B. Erection and installation of work covered by this Section shall be performed by building manufacturer's personnel or by subcontractors Certified by the building manufacturer for erection and installation of manufacturer's products. Subcontractor shall be thoroughly familiar with manufacturers product, having a minimum of five (5) years experience installing projects of this nature. Erection work shall be under direction and supervision of an experienced supervisor employed by manufacturer of the Certified subcontractor.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon arrival at job site, sheets and panels shall be inspected for moisture accumulation. If found wet, remove moisture, re-stack, and protect sheets and

panels until used.

B. Store metal sheets or panels to allow water which has accumulated during transit or storage to drain. Do not store sheets and panels in contact with materials which cause staining.

C. Deliver, store, and handle prefabricated components, sheets, panels, and other manufactured items in such a manner that they will not be damaged or deformed. Stack materials stored on site on platforms or pallets and cover with tarpaulins or other suitable vented weathertight covering.

1.07 WARRANTY

A. Roof and Wall Panels: Provide 20-year weather tightness warranty, by building manufacturer, covering durability of roof and wall panels due to rupture, structural failure, or perforation.

B. Roof and Wall Panel Finish (exterior color bake-on): Provide 20-year warranty, by building manufacturer, covering panel finish against blistering, peeling, cracking, flaking, checking, chipping, and excessive color change and chalking. Color change shall not exceed 9 N.B.S. units for roof panels and 5 N.B.S. units for wall panels, (per ASTM D2244.64T) and chalking for wall panels shall not be less than a rating of 8 per ASTM D659-86.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hot Rolled Structural Shapes: ASTM A36, ASTM A529, or ASTM 992 with 36 ksi or 50 ksi minimum yield stress.

B. Tubing or Pipe: ASTM A500, Grade C; ASTM A501; or ASTM A53, Type E, Grade B.

C. Plate or Bar Stock: 42,000 PSI minimum yield strength: ASTM A529, ASTM A570, or ASTM A572.

D. Cold-Formed Steel: ASTM A607, Grade 50 minimum.

E. Galvanized Steel Sheet: ASTM A446, G90 coating, or ASTM A525, G90.

F. Bolts for Framing: ASTM A307 or ASTM A325.

G. Primer Paint: Manufacturer's standard gray and shall conform to Steel Structure Painting Council Specifications TT-P-636.

2.02 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following

1. American Buildings
2. Butler
3. Gulf States
4. MBCI
5. Metal Sales
6. *Inland Buildings*
7. *Architectural Integrated Metal, Inc.*
8. *Dean Steel Buildings, Inc.*
9. *Star Building Systems*

B. Roofing panels shall match MBCI, Ultra-Dek, 24 gauge

C. Wall panels shall match MBCI, “U” panel, 24 gauge

D. Soffit and liner panels shall match MBCI Artisan L12 with beads 26 gauge.

2.03 ROOF PANEL MATERIAL

A. Galvalume sheet conforming to the requirements of ASTM A792 with an AZ55 coating.

2.04 WALL AND SOFFIT PANEL AND GUTTERS AND DOWNSPOUTS MATERIAL

A. Structural Quality Galvanized Steel Sheet: Hot-dip zinc-coated steel sheet complying with ASTM A 446 with G90 coating complying with ASTM A525, Grade C or to suit manufacturer's standards. Provide sheet material matching formed panel finishes for building trim and closures.

B. METAL FINISHES

1. General: Apply coating either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating by application of strippable film to properly protect finish. Furnish air-drying spray finish in matching color for touch-up.
   a) Color shall be as indicated from manufacturer's color selections, both standard and custom. Provide minimum sixteen (16) colors.
2. Fluoropolymer Coating: Manufacturer's standard two coat, themocured, full strength 70 percent "Kynar 500" coating consisting of a primer and a minimum 0.75mil dry mil thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with STM D 523.
   a) Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of NO. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.

2.05 INSULATION:

A. Roof: Two layers (6 inches total) R-19 plus R-19 liner system for total R-38.

1. Roof insulation shall be flexible, noncombustible fiberglass blankets with vapor resistant membrane. Vapor resistant membrane shall be laminated to insulation as composite unit. Insulation and vapor membrane shall carry Underwriters Laboratories Inc. (U.L. label) fire hazard classification indicating flame spread rating of 25 or less and a smoke developed rating of 450 or less, as a tested assembly.
2. Insulation system shall be applied under exposed metal roofing panels and over the roof support member. Vapor membrane shall always be placed to interior of building, whether it be exposed or nonexposed. Joints shall be lapped, taped, or folded, and stapled in accordance with building manufacturer's standard. Vapor membrane shall have a perm rating of not more than 0.02.
3. With R-19 blanket-type insulation only, thermal spacer (block) shall separate roof support member from roof panel, except at each concealed structural fastener. Spacer shall be of material having density of not less than 2 pcf and, if combustible material, shall be classified as having flame spread rating not greater than 25 when tested in accordance with ASTM E84-84.

B. Walls: One layer (4 inches total) R-13 plus R-13 continuous insulation for total R-26.

1. Wall insulation shall be flexible, noncombustible fiberglass blankets with vapor resistant membrane. Vapor resistant membrane shall be laminated to insulation as composite unit. Insulation and vapor membrane shall carry Underwriters Laboratories Inc. (U.L. label) fire hazard classification indicating flame spread rating of 25 or less and a smoke developed rating of 450 or less, as a tested assembly.
2. Continuous insulation shall be foil-faced polyisocyanurate board R-6.5

minimum.

3. Insulation system shall be applied under exposed metal wall panels and over the wall support member. Vapor membrane shall always be placed to interior of building, whether it be exposed or nonexposed. Joints shall be lapped, taped, or folded, and stapled in accordance with building manufacturer's standard. Vapor membrane shall have a perm rating of not more than 0.02.

2.06 GUTTERS AND DOWNSPOUTS

A. Gutters: Gutters shall be provided complete with mitered corners, end pieces, and special pieces that may be required. Gutters shall be formed in sections not less than eight feet in length. Ends of each length shall be joined with riveted and sealed joints, except that expansion-type slip joints shall be provided at center of runs, unless specified otherwise. Gutters shall be supported on hangers of approved type, spaced at 36" o.c. maximum. Hangers and fastenings shall be constructed of metal compatible with gutters.

B. Downspouts: Provide shapes and sizes as indicated on drawings, complete including elbows and offsets. Downspouts shall be provided in approximate 10' lengths; end joints shall telescope not less than 1-1/2", and longitudinal joints shall be locked. Gutter outlets shall be provided with zinc-coated steel, stainless steel, or nonferrous metal wire ball strainers of standard type. Downspouts shall be kept not less than 1" away from walls, and shall be fastened to walls to top, bottom, and at maximum 5' centers intermediately between, with leader straps, or concealed type fasteners; straps and fasteners shall be formed from metal compatible with the downspouts.

2.07 ACCESSORIES

A. Fasteners for Securing Panels:

1. Fasteners for roof panels shall be 20 year fasteners.
2. Provide fasteners for roof panels installed over purlins with 6-inch insulation and roof panels over iso foam insulation installed on type “B” metal deck.
3. Fastening system shall be designed to withstand design loads specified herein.

B. Sheet Metal Accessories:

1. Zinc-coated steel accessories shall be provided with zinc-coated siding or roofing, and aluminum accessories shall be provided with aluminum alloy siding or roofing. Zinc-coating for all sheet steel accessories, including continuous ridge vents, and louvers shall conform to 1.25 oz. PSF coating class.
2. Caps, Strips, and Plates:
   a) Ridge caps, eave and edge strips, fascia strips, miscellaneous flashings, and miscellaneous sheet metal accessories, unless specified otherwise, shall be formed from the same materials and gauge as roof covering.
   b) Wall plates, base angles or base channels, and other miscellaneous framing members may be standard structural steel shapes, or may be formed from steel not lighter than 16 gauge.
3. Roof Jacks and Curbs
   a) Openings 8" or smaller may be flashed and sealed to roof panel by jacks, providing complete structural support and weathertightness are maintained. Material shall be either metal with protective metallic coating or EPDM material with aluminum sealing ring base.

b) Openings larger than 8", round or square, shall be framed with welded metal base fabricated from 0.07" thick (minimum) galvanized steel. Base and related appurtenance shall be supported by roof purlins and header framing. Base shall have minimum projection of 8" above weather surface of roof, and configuration of flanges shall match roof panel. Design of flanges shall provide for lapping of roof panels in shingle-fashion so that installation is water tight without depending on sealant. Flange-to-panel joint shall be sealed with nonhardening sealant and fastened in manner to provide complete support and weathertightness.

C. Miscellaneous Accessories:

1. Closure Strips: Formed of approved solid synthetic or natural rubber, or other material, standard with manufacturer of system furnished. Molded closure strips shall be free of opened voids and shall not absorb or retain water. Closure end strips shall be formed to match the corrugations or configurations of the roofing or siding being used and shall be provided where indicated and elsewhere to provide weathertight construction. Sealing material shall be used also for sealing joints in and around sealing strips at ridges, eaves, valleys, bottom course in siding on vertical surfaces, bolt holes before inserting fasteners, for flashings and corner closure sheets, and elsewhere to provide watertight construction. Bituminous type sealing materials shall not be used with factory color coated or painted sheets and panels.
2. Joint Sealing Material: Type as recommended by roofing and siding manufacturer to seal side and end laps in metal roofing of deep corrugation type where slope of roof is less than 3 in 12". Material shall be applied in accordance with manufacturer's printed instructions of material furnished. sealing material shall be used also for sealing joints in and around sealing strips at ridges, eaves, valleys, bottom course in siding on vertical surfaces, bolt holes before inserting fasteners, for flashing and corner closure sheets, and elsewhere to provide watertight construction. Bituminous type sealing materials shall not be used with factory color coated or painted sheet or panels.

2.08 FABRICATION

A. Structural steel members shall be sheared, formed, punched, welded and painted in plant of manufacturer.
B. Welding shall be in accordance with standard practices of the American Welding Society, and shall be performed by qualified welders.
C. Clearly and legible mark each piece and part of assembly to correspond with previously prepared erection drawings, diagrams and instruction manuals.
D. Surface preparation shall conform to requirements of Steel Structures Painting Council Specification SSPC-SP3.
E. Paint shall conform to requirements of Steel Structures Painting Council Specification TT-P-636.
F. Dissimilar Materials:

1. Where aluminum surfaces come in contact with ferrous metal or other incompatible metals, the aluminum surfaces shall be kept from direct contact by one of the following methods:
   a) Paint incompatible metal with coating of heavy-bodied bituminous paint.
   b) Paint incompatible metal with prime coat of zinc-chromate primer followed by one or two coats of aluminum metal-and-

masonry paint, or other protective coating, excluding those containing lead pigmentation.
c) Nonabsorptive gasket.
d) Caulk between aluminum and incompatible metal.

2. If drainage from incompatible metal passes over aluminum, incompatible metal shall be painted by Method "a" or Method "b" above. Aluminum surfaces in contact with concrete or masonry materials shall be painted by Method "a". Green or wet wood, or wood treated with preservative, shall be painted by Method "a" or shall be given two coats of aluminum paint.

G. Finish:
1. Roof Panels: Galvalume or aluminized steel.
2. Wall and Other Panels: Kynar 500 fluoropolymer coating with minimum 70% resins; manufacturers standard color as shown on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine substrate and conditions under which work is to be installed. Notify Contractor in writing of any conditions detrimental in installation of work. do not proceed with work until unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Framing Members: Plumb in both directions, guy and stay and space framing elements to assure proper fitting of prefabricated wall and roof coverings.
B. Wall and Roof Panels:
1. Wall Construction: Panels shall be applied with corrugations, ribs, or other configurations in vertical position. Panels shall be supplied in full wall height from base to eave with no horizontal joints except at junctions of door frames, window frames, louver panels, and similar locations. Side and end laps shall be sealed with joint sealing materials specified herein. Walls shall be flashed and sealed at base, at top, around windows, doors, framed louvers, and other similar openings. Placement of closure strips, flashing and sealing materials shall be accomplished in manner which will assure complete weathertightness. Flashing will not be required where approved "self-flashing" sheet or panels are used. Minimum end laps for panels shall be 2-1/2". Minimum side laps for panels shall be one corrugation or one configuration. side and end laps shall be sealed as specified herein for roofing, except that only one bead of plastic cement shall be required.
2. Roof Construction: Roof slope shall be as indicated. Roofing panels shall be applied with corrugations, ribs, or other configurations parallel to slope of the roof. Roofing panels shall be supplied in longest lengths obtainable with end laps occurring only at structural members. Roof curb units shall be installed in sequence with roof panels in shingle-fashion and location of units may be adjusted laterally up to 12 inches from locations shown to work with standing seams. Side laps shall be laid away from prevailing wind. Side and end laps shall be sealed with joint sealing material specified herein. Flash and seal roof at ridge, eaves, rakes, and projections through roof, and elsewhere to assure weathertight construction. Placement of closure strips, flashing, and sealing material shall be accomplished in an approved manner which will assure weathertightness. Contact surfaces between roofing sheets at end

and side laps shall be sealed with plastic cement, squeezed from pressure gun and forming two beads, each not less than 1/4" thick or building manufacturer's standard application.

3. Liner Panels: Where liner panels are installed in inmate areas (dayrooms and exercise) all edges shall be protected with an 18 ga angle connected to wall or abutted structure with tamper resistant screws. All connectors visible in finished job shall be tamper resistant.

C. Defects: Defects or errors in fabrication of building components shall be corrected by Contractor in a manner approved by the Architect. Defects or errors in fabrication of components, which cannot be corrected in an approved manner, shall be replaced by nondefective members at no additional cost to the Owner.

3.03 TOLERANCES

A. Framing Members: AISC Code of Standard Practice and Commentary and MBMA Code of Standard Practice and Commentary, latest editions.

END OF SECTION 133419

SECTION 133450 – ALUMINUM WALKWAY COVER

PART I GENERAL

1.01 DESCRIPTION OF WORK SHALL INCLUDE FURNISHING AND INSTALLING THE FOLLOWING:

A. Provide aluminum, column supported canopy with concrete footings at designated location, including all necessary accessories to achieve configurations and profiles as requested by customer and specified in this section.
B. Work of this section includes design, engineering, fabrication, and installation of an extruded aluminum, column supported canopy system with baked enamel finish.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for components and accessories.
B. Shop Drawings: Submit complete erection drawings showing footing locations and size, bent layout, and flashing details. Detailed shop drawings shall be submitted, sealed by a Structural Engineer registered in the State of South Carolina.
C. Certification: Submit written Certification prepared and signed by Structural Engineer registered in the State of South Carolina verifying that canopy design will safely resist wind uplift as computed by ANSI A58.1, IV = 150 mph, as well as meet indicated loading requirements for the 2018 IBS and wind loading requirements of the latest ANSI/ASCE 7-98, live and dead loads and other load requirements in accordance with the IBC, 2018 Edition.
D. The indiscriminate submittal of general structural calculations that have not been specifically prepared for this project will be rejected.

1.03 QUALITY ASSURANCE

A. Manufacturer to accept total responsibility, from structural design and engineering through fabrication finishing, delivery and reception by factory trained and certified mechanics. Manufacturer shall be a specialist with a minimum five years documented experience in manufacturing product. Installer shall be specialized with a minimum five years documented experience in erecting and applying the work, approved and certified by manufacturer.
B. Design Loads: Provide building mounted canopy structures capable of sustaining 150 mph wind speed, and capable of supporting 20 psf live load on roof
C. Design each member to withstand stresses resulting from combinations of loads that produce maximum percentage of actual to allowable stress in that member.
D. Provide the aluminum canopy covers including all necessary accessories from one single source manufacturer.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and protect products as instructed by manufacturer.
B. Promptly inspect shipment to assure the products comply with requirements, quantities are correct, and products are undamaged.
C. Stack materials to prevent twisting, bending, or abrasion, and to provide ventilation.
D. Slope metal sheets to ensure drainage.
E. Prevent contact with materials during storage that may cause discoloration or staining.

1.05 WARRANTY

A. Provide one (1) year warranty by manufacturer for installation and materials to cover metal failure, fastener failure, and finish failure. Warranty shall also include, but not limited to, coverage for structural, water tightness and finish beginning the day of Substantial Completion of Installation.

PART 2 MATERIALS

2.01 MATERIALS

A. Aluminum Beams and Tubing: 6063 alloy heat treated to a T-6 temper, and with note less than the strength and durability properties specified in ASTM B 221 for 6063-T6.
B. Deck Fasteners: 18-8 stainless steel screws, sealed with neoprene "O" ring beneath stainless steel.
C. Wet beams shall be open-top tubular extrusions of size and shape required by engineer; top edges thickened for strength and designed to receive deck members in a self-flashing manner. Extruded structural rain cap ties shall be installed in the top of all wet beams.
D. Deck shall be extruded self-flashing sections interlocking into a composite unit with sufficient camber to offset dead load deflection and cause positive drainage.
E. Fascia shall be manufacturer's standard shape.
F. Material Thickness: Provide minimum thickness of metal as follows:
    a. Beams and Columns: 0.125 inches on vertical faces and 0.190 inches on horizontal faces.
    b. Deck: 0.060 inches
    c. Flashing: 0.032 inches

2.02 BASIS OF DESIGN

A. Products manufactured by:

Tennessee Valley Metals, Inc.
East Coast TVM (Carolina's) (843)346-3885
2720 Southeastern Circle
Birmingham, AL 35215

B. Equal products of other manufacturers are approved.

2.03 FABRICATION

A. Drainage: Water shall drain internally from deck to wet beams, for discharge out rain diverters in columns at grade level.
B. Bent Construction: Beams shall be heli-arc welded into rigid, once-piece units in the manufacturer's plant. When size of system does not permit shipment, anodizing, or painted finish as welded units, mechanical joints shall be employed. All welded construction is to be ground smooth prior to finishing.
C. Field welding is not permitted.
D. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 18" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The

fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

2.04 FINISHES

A. Standard baked enamel, AAMA 2603. Color selected by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Field verify beam location dimensions and elevation as shown on shop drawings prior to fabrication.
B. Erection shall be performed by manufacturer-approved erectors and shall be scheduled for erection with owner.
C. All deck ends and beam joints shall be capped as required to control drainage.
D. Butt and miter joints shall be executed in a workman like manner.
E. Canopy shall be erected true to line, level and plumb free from distortion or defects detrimental to appearance and performance.
F. No exposed interlocking deck joints visible on the underside of the deck.
G. Flashing shall be installed at all locations adjoining existing buildings.

3.02 Cleaning

A. Clean all canopy cover components promptly after completion.

3.03 Protection

A. Extreme care shall be taken to protect the finish from scratches, nicks, gouges, dents, concrete exposure, etc. during assembly and installation.

END OF SECTION 133450

East Coast TVM

Aluminum Canopy Systems

Manufactures & Installers of:

- Aluminum Walkways
- Canopy Systems
- Fabric Awnings
- Bahama Shutters
- Ornamental Brackets
- Sun Shades

Aluminum Walkway & Canopy Systems

CUSTOM BUILT TO YOUR DESIGN SPECIFICATIONS & PROJECT REQUIRMENTS

Tennessee Valley Metals is one of the leading manufacturers of aluminum extruded and roll-form canopy systems in the southeast. With over 44 year's experience, we assist in all elements related to design and engineering of a canopy system that will fit both your needs and most budgets. Our canopy systems are fabricated using the highest quality components to ensure long life and durability and are designed to follow local building codes and specific architectural requirements.

Fabric Awnings

Colorful Touches

If you want to spruce up your storefront or if you are looking for an elegant way to add color and stylish looks to your business front entry we have the perfect fabric awning designs for you. Utilizing Sunbrella Fabrics with Kevlar stitching we can achieve the look you want with durability that you require.

We also have a full range of vinyl covers if fabric is not quite what you had in mind. We have a wide variety of colors and configurations to accent your school, home, or business.

Custom Fabrications

Artistic, Colorful & Durable

With our in house welding shop and our unique fabricating abilities we offer a wide range of custom offerings for our clients. We have special shape decorative brackets, Bahama shutters, sun shades for building accents and decorative aluminum trellis structures which can serve as excellent study, sitting or break areas.

"We strive to bring your ideas and sketches to life"

CUSTOM SOLUTIONS

East Coast TVM has the ability to fabricate custom aluminum framing and components for walkway & canopy systems. One of the most overlooked aspects of walkway canopies is the lighting. We have custom extrusions that allow for concealed conduit while providing a waterproof light anchoring system that maintains the aesthetics that architects demand on their projects.

Our promise to you

Here at East Coast TVM we work hard to provide our clients with the highest quality materials and craftsmanship on the market today. We strive to meet and exceed your schedules, budgets, and expectations and it is our goal to make your experience with our company the best it can be.

East Coast TVM, LLC
Aluminum Canopy Systems

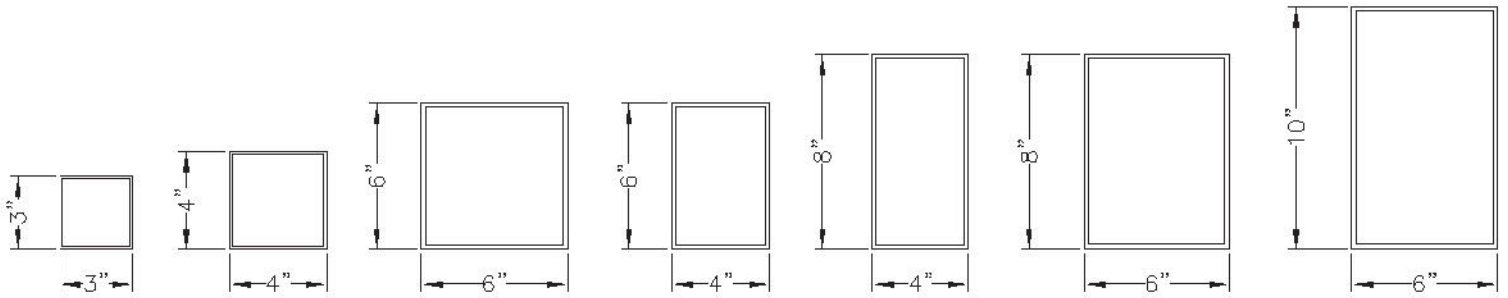
4709 Fraley Dr.
Timmonsville, SC 29161

P.O. Box 4008
Florence, SC 29502

Phone: (843) 346-3885
Fax: (843) 346-3913

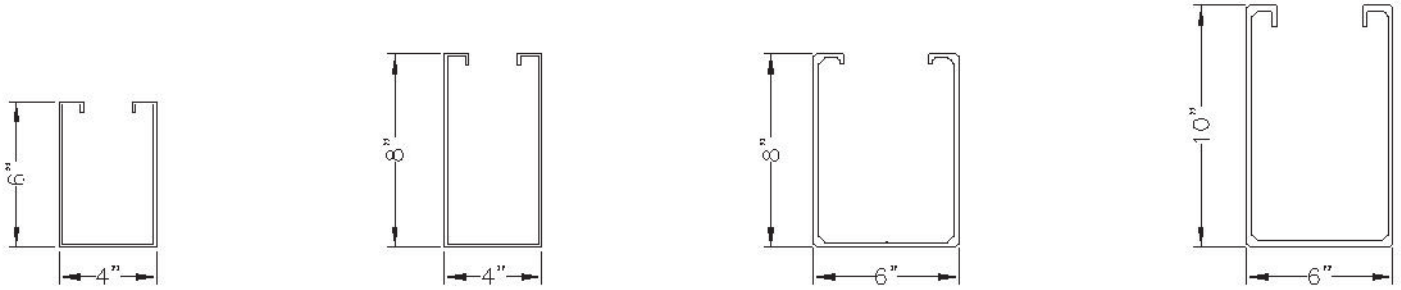
www.tvmetals.com

COLUMNS



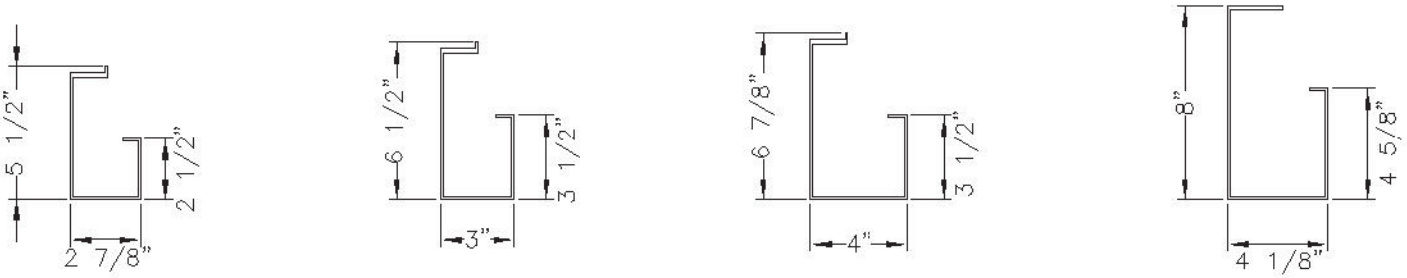
3" x 3" x .125" | 4" x 4" x .125" | 6" x 6" x .188" | 4" x 6" x .150" | 4" x 8" x .150" | 6" x 8" x .188" | 6" x 10" x .188"

DRAINAGE BEAMS



4" x 6" x .125" | 4" x 8" x .150" | 6" x 8" x .188" | 6" x 10" x .188"

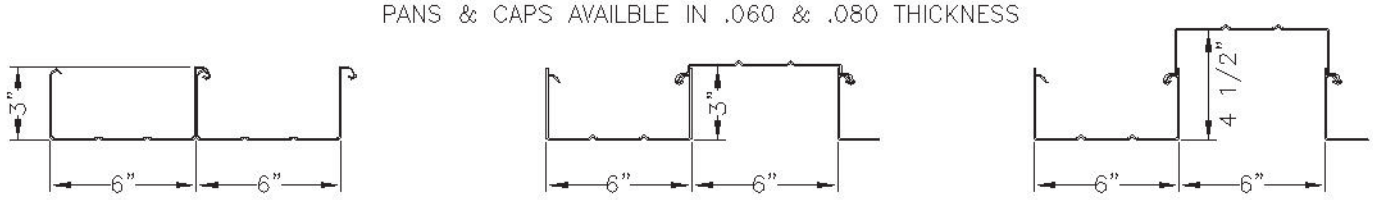
FASCIA / GUTTERS



5" FASCIA | 6" FASCIA | 7" FASCIA | 8" FASCIA

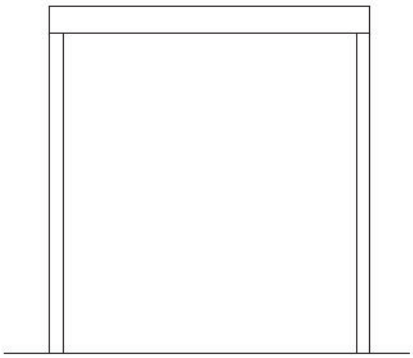
EXTRUDED DECK SYSTEMS

PANS & CAPS AVAILBLE IN .060 & .080 THICKNESS

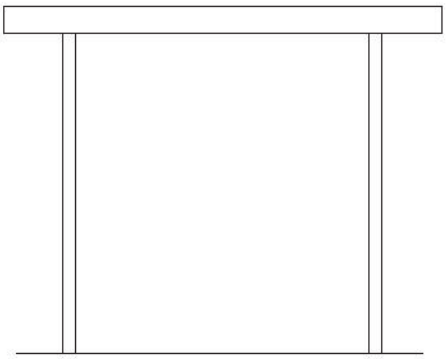


3" FLAT PAN | 3" PAN & CAP | 4 1/2" PAN & CAP

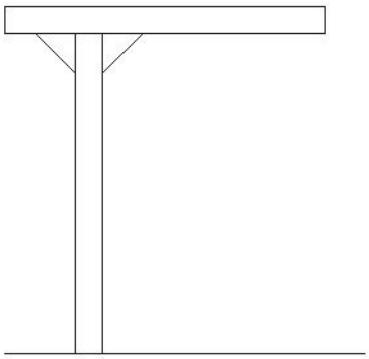
Other shapes and deck options are available – contact East Coast TVM for more details



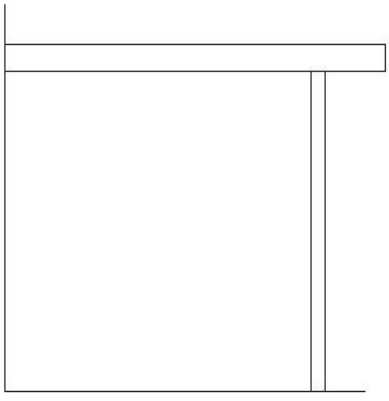
BENT TYPE 1



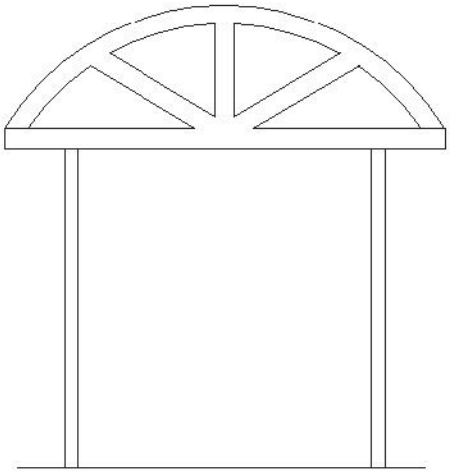
BENT TYPE 2



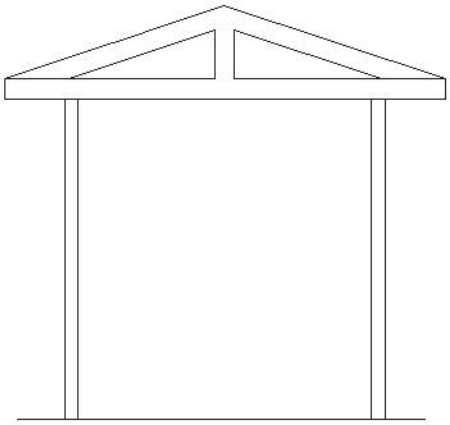
BENT TYPE 3



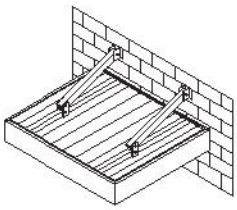
BENT TYPE 4



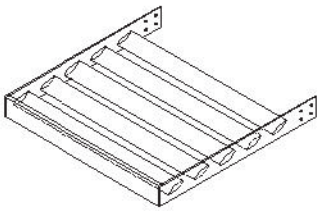
BENT TYPE 5



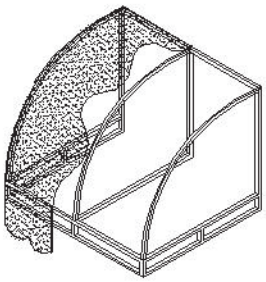
BENT TYPE 6



OVERHEAD SUPPORTED



SUN SHADES



FABRIC AWNINGS

Made in the USA

We are proud to say that the materials used in our canopy systems are made in the USA by companies that are American owned and operated.

Our facilities are located in the Pee Dee region of South Carolina and we provide service to customers throughout the southeast region.

BUILDING GREEN

The aluminum used in our canopy system is a 100% recyclable material and qualify for credits under the LEED accreditation MR4.1, 4.2 & MR5.1 & 5.2.
(LEED is a trademark of the US GBC)

FINISHES OPTIONS

- **Standard Baked Enamel AAMA 2603**
- **High Performance Kynar AAMA 2605 – 2 coat**
- **High Performance Kynar AAMA 2605 – 3 coat**
- **Class II Clear Anodized 204-R1 0.4 mill coating thickness.**
- **Class I Clear Anodized 215 – R1 0.7 mill coating thickness.**
- **Custom Powder Coating color also available**

STANDARD COLORS

WHITE

BRONZE

CLEAR ANODIZED

KYNAR COLORS

CARDINAL RED (REQUIRES UPCHARGE)

BURGUNDY

MEDIUM BRONZE

DARK BRONZE

HARTFORD GREEN

HEMLOCK GREEN

INTERSTATE BLUE

MATTE BLACK

MILITARY BLUE

COLONIAL RED

PATINA GREEN

SANDSTONE

SIERRA TAN

GRANITE

SLATE GRAY

TERRA COTTA

EVERGREEN

CHARCOAL

THESE COLORS ARE PROVIDED FOR INFORMATION PURPOSES. WE RECOMMEND USING ACTUAL COLOR CHIPS BEFORE FINAL COLOR SELECTIONS ARE MADE.

CUSTOM COLORS ALSO AVAILABLE

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of contract, including General & Supplementary Conditions and Division 1 Specification Sections, shall apply to work specified in this section.

1.02 General Description of Work

A. Work in this section shall include design, fabrication and installation of complete welded, extruded aluminum canopy system. All work shall be in complete accordance with the drawings and this specification.

1.03 References

A. Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.
B. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
C. American Architectural Manufactures Association (AAMA).
D. American Society for Testing and Materials (ASTM).

1.04 Related Sections

A. Concrete Work – Section 03300
B. Masonry Work – Section 04200
C. Miscellaneous Metals – Section 05500
D. Flashing and Sheet Metal – Section 07600
E. Sealants – Section 07900

1.05 Submittals

A. Product Data: Submit manufacture's product information, specifications and installation instructions for components and accessories.
B. Shop Drawings: Submit complete erection drawings showing attachment system, column and gutter beam framing, transverse cross sections, covering and trim details, and option installation details to clearly indicate proper assembly of components. Detail shop drawings shall be submitted, sealed by a State Registered Structural Engineer.
C. Certification: Submit written Certification prepared and signed by a State Registered Structural Engineer verifying that framing design will safely resist wind uplift loading requirements of the current International building Code (IBC), as well as complying with ANSI/ASCE 7.

1.06 Quality Assurance

A. Codes and Standards: Comply with provisions of the following except as otherwise indicated: Current International Building Code (IBC). American Welding Society (AWS) standards for structural aluminum welding.
B. Manufacturer: Obtain aluminum covered walkway system from only one (1) manufacturer, although several may be indicated as offering products complying with requirements.
C. Installer Qualifications: Firm with not less than three (3) years experience in installation of aluminum walkway covers of type, quality and installation methods similar to work of this section.
D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting work.
E. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway system (sidewalk, curbs, building fascias, etc.)

1.07 Warranty

A. Provide manufactures standard one-year warranty that shall include, but not limited to, coverage for structural, water tightness and finish beginning the day of Substantial Completion of Installation.

PART 2 – PRODUCT

2.01 Manufactures

A. Contract documents are based on products manufactured by:
Tennessee Valley Metals Inc., East Coast TVM (Carolina's) (843)346-3885
2720 Southeastern Circle,
Birmingham, AL 35215
(205)853-1125, FAX (205)853-1314
(800)551-2579
sales@tvmetals.com,
www.tvmetals.com
B. Interested manufactures will be considered for substitution only when the following conditions are met: Complete details, including sizes of all members and structural calculations showing loads applied in accordance with the specification must be submitted to the architect for review. Submit complete details with structural properties (moment of inertia, section modules, modules of elasticity, etc.) for all proposed sections (bents, columns, decking, and other structural members).

2.02 Materials

A. Aluminum Extrusions: All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper.
B. Finishes: For factory baked enamel finish, specify AAMA 603.8 standard or custom color. For satin anodized finish, 204.R1 meeting aluminum association specification AA-M-10C-22A21. For flouropolymer (kynar) finish, specify AAMA 605.2, two or three coats.

2.03 Components

A. Columns: Columns shall be radius cornered tubular extrusions of size shown on drawings with cutout and internal diverter for drainage where indicated. Circular downspout opening in column is not acceptable.
B. Beams: Beams shall be open-top tubular extrusions of size and shape shown on drawings, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of all beams.
C. Deck: Deck shall be extruded self-flashing sections interlocking into a composite unit.
D. Fascia: Fascia shall be manufacture's standard shape. Size as indicated on drawings.
E. Flashing: Flashing shall be .032 aluminum (min.). All thru-wall flashing is completed by others.
F. Arches: Arches for barrel vault protective covers shall be sharp-cornered tubular extrusions of size shown in drawings.

2.04 Fabrication

A. Drainage: Water shall drain internally from deck to beams to columns, for discharge out to rain diverters at or below ground level as indicated on architectural drawings.
B. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 18" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastening must have minimum shear strength of 350 lbs. each. Deck shall be assembled with sufficient camber to offset dead load deflection.

PART 3 – EXECUTION

3.01 Preparation

A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 Installation

A. Column Sleeves: Column sleeves (Styrofoam block outs) or anchor bolts (if required) shall be furnished by Tennessee Valley Metals, Inc. and installed by the General Contractor.
B. Erection: Protective cover shall be erected true to line, level and plumb.

3.03 Cleaning

B. All protective cover components shall be cleaned promptly after installation.

3.04 Protection

C. Extreme care shall be taken to protect materials during and after installation.

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Concrete bases.
7. Supports and anchorages.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical 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 mechanical 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.

1.03 SUBMITTALS

A. Welding certificates.

1.04 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 Fire-Suppression 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

2.01 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 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.

2.02 JOINING MATERIALS

A Refer to individual Division 21 piping Sections for special joining materials not listed below.

B Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F Welding Filler Metals: Comply with AWS D10.12.

G Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.03 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, NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C Pressure Plates: Plastic, Carbon steel, Stainless steel. Include two for each sealing element.

D Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating ,Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 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.

E Underdeck Clamp: Clamping ring with set screws.

F Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

G PVC Pipe: ASTM D 1785, Schedule 40.

H Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.05 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.

D Finish: Polished chrome-plated, Polished chrome-plated and rough brass.

E Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated, Polished chrome-plated and rough brass.

2.06 GROUT

A Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

B Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
C Design Mix: 5000-psi, 28-day compressive strength.
D Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS
A Install piping according to the following requirements and Division 21 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.
O Install steel pipe for sleeves smaller than 6 inches in diameter.
P Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
Q 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.
R 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.
S 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.
T 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.
U Verify final equipment locations for roughing-in.
V Refer to equipment specifications in other Sections of these Specifications for

roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A Join pipe and fittings according to the following requirements and Division 21 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 Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.03 CONCRETE BASES

A Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

B Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

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 the base.

D Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

E Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

F Install anchor bolts to elevations required for proper attachment to supported equipment.

G Install anchor bolts according to anchor-bolt manufacturer's written instructions.

H Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete Miscellaneous Cast-in-Place Concrete."

3.04 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 fire-suppression materials and equipment.

C Field Welding: Comply with AWS D1.1.

3.05 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression 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.

3.06 GROUTING

A Mix and install grout for fire-suppression 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

SECTION 211100

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building [and service entrance piping through floor into the building] [and service entrance piping through wall into the building].

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

C. Related Sections:

1. Division 21 Section "Fire-Suppression Standpipes" for fire-suppression standpipes inside the building.
2. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe fire-suppression sprinkler systems inside the building.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Field quality-control reports.

1.03 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 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, by a qualified testing agency, and marked for intended location and application.

D. Comply with the "Approval Guide," published by FM Global, or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.04 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L ASTM B 88M, Type B, water tube, annealed temper.

B. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

C. 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.

D Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
E 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.

2.02 DUCTILE-IRON PIPE AND FITTINGS
A Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
B Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
C Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.
D Grooved-End, Ductile-Iron Pipe Appurtenances:
E 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:
1. Anvil International, Inc.
2. Shurjoint Piping Products.
3. Star Pipe Products.
4. Victaulic Company.
F Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
G 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.
H Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
I Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
J Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
K Gaskets: AWWA C111, rubber.
L Flanges: ASME B16.1, Class 125, cast iron.

2.03 SPECIAL PIPE FITTINGS
A Ductile-Iron Flexible Expansion Joints:
B 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:
1. EBAA Iron, Inc.
2. Hays Fluid Controls; a division of ROMAC Industries Inc.
3. Star Pipe Products.
C 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.
D Pressure Rating: 250 psig (1725 kPa) minimum.

2.04 ENCASEMENT FOR PIPING
A Standard: ASTM A 674 or AWWA C105.
B Material: Linear low-density PE film of 0.008-inch or High-density, cross-laminated PE film of 0.004-inch minimum thickness.
C Form: Sheet or tube.
D Color: Black or natural.

2.05 JOINING MATERIALS
A Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos

free.

B Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

2.06 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:

C 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:

1. Cascade Waterworks Manufacturing.
2. Dresser, Inc.; Dresser Piping Specialties.
3. Ford Meter Box Company, Inc. (The); Pipe Products Division.
4. Hays Fluid Controls; a division of ROMAC Industries Inc.
5. JCM Industries.
6. Smith-Blair, Inc.; a Sensus company.
7. Viking Johnson.

D 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.

E Standard: AWWA C219.

F Center-Sleeve Material: Manufacturer's standard Stainless steel.

G Gasket Material: Natural or synthetic rubber.

H Pressure Rating: 200 psig minimum.

I Metal Component Finish: Corrosion-resistant coating or material.

2.07 CORPORATION VALVES] [AND] [CURB VALVES]

A 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]:

1. Amcast Industrial Corporation.
2. Ford Meter Box Company, Inc. (The); Pipe Products Division.
3. Jones, James Company.
4. Master Meter, Inc.
5. McDonald, A. Y. Mfg. Co.
6. Mueller Co.; Water Products Division.
7. Red Hed Manufacturing & Supply.

B Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine and manifold.

C Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.

D Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

E Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

F Curb Valves: Comply with AWWA C800 for high-pressure service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

G Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

H Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

I Meter Valves: Comply with AWWA C800 for high-pressure service-line valves.

Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.08 GATE VALVES

A AWWA Gate Valves:

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. American AVK Company; Valves & Fittings Division.
   b. American Cast Iron Pipe Company; American Flow Control Division.
   c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   d. American R/D.
   e. Clow Valve Company; a division of McWane, Inc.
   f. Crane Co.; Crane Valve Group; Stockham Division.
   g. East Jordan Iron Works, Inc.
   h. Kennedy Valve; a division of McWane, Inc.
   i. M&H Valve Company; a division of McWane, Inc.
   j. Mueller Co.; Water Products Division.
   k. NIBCO INC.
   l. Tyler Pipe; a division of McWane, Inc.; Utilities Division.
   m. U.S. Pipe.
2. 200-psig (1380-kPa), AWWA, Iron, Nonrising-Stem, Metal-Seated Gate Valves:
3. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
   a. Standard: AWWA C500.
   b. Pressure Rating: 200 psig (1380 kPa).
   c. End Connections: Mechanical joint.
   d. Interior Coating: Complying with AWWA C550.

B 200-psig (1380-kPa), AWWA, Iron, Nonrising-Stem, Resilient-Seated Gate Valves:

1. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
2. Standard: AWWA C509.
3. Pressure Rating: 200 psig (1380 kPa).
4. End Connections: Mechanical or push-on joint.
5. Interior Coating: Complying with AWWA C550.

C 200-psig (1380-kPa), AWWA, Iron, OS&Y, Metal-Seated Gate Valves:

1. Description: Cast- or ductile-iron body and bonnet; with cast-iron double disc, bronze disc and seat rings, and bronze stem.
2. Standard: AWWA C500.
3. Pressure Rating: 200 psig (1380 kPa).
4. End Connections: Flanged or grooved.

D 200-psig (1380-kPa), AWWA, Iron, OS&Y, Resilient-Seated Gate Valves:

1. Description: Cast- or ductile-iron body and bonnet; with bronze, gray-iron, or ductile-iron gate; resilient seats; and bronze stem.
2. Standard: AWWA C509.
3. Pressure Rating: 200 psig (1380 kPa).
4. End Connections: Flanged or grooved.

E Class 125, Bronze, Nonrising-Stem Gate Valves:

1. Description: Class 125, Type 1; bronze with solid wedge and malleable-iron handwheel.
2. Standard: MSS SP-80.

3. Pressure Rating: 200 psig (1380 kPa).
4. End Connections: Solder joint or threaded.

F UL-Listed or FM-Approved Gate Valves:

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. American AVK Company; Valve & Fittings Division.
   b. American Cast Iron Pipe Company; American Flow Control Division.
   c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   d. Clow Valve Company; a division of McWane, Inc.
   e. Crane Co.; Crane Valve Group; Jenkins Valves.
   f. Crane Co.; Crane Valve Group; Stockham Division.
   g. East Jordan Iron Works, Inc.
   h. Hammond Valve.
   i. Kennedy Valve; a division of McWane, Inc.
   j. M&H Valve Company; a division of McWane, Inc.
   k. Milwaukee Valve Company.
   l. Mueller Co.; Water Products Division.
   m. NIBCO INC.
   n. Shurjoint Piping Products.
   o. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
   p. Tyco Fire & Building Products LP.
   q. United Brass Works, Inc.
   r. U.S. Pipe.
   s. Watts Water Technologies, Inc.

G 175-psig (1200-kPa), UL-Listed or FM-Approved, Iron, Nonrising-Stem Gate Valves:

1. Description: Iron body and bonnet, bronze seating material, and inside Pressure Rating: 175 psig (1200 kPa) minimum.screw.
2. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200) minimum.
4. End Connections: Mechanical or push-on joint.
5. Indicator-Post Flange: Include on valves used with indicator posts.

H 175-psig (1200-kPa), UL-Listed or FM-Approved, Iron, OS&Y, Gate Valves:

1. Description: Iron body and bonnet and bronze seating material.
2. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
3. End Connections: Flanged or grooved.

I UL-Listed or FM-Approved, OS&Y Bronze, Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.
2. Description: Bronze body and bonnet and bronze stem.
   a. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
   b. Pressure Rating: 175 psig (1200 kPa) minimum.

c. End Connections: Threaded.

2.09 GATE VALVE ACCESSORIES AND SPECIALTIES

A Tapping-Sleeve Assemblies:

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. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   b. Clow Valve Company; a division of McWane, Inc.
   c. East Jordan Iron Works, Inc.
   d. Flowserve.
   e. Kennedy Valve; a division of McWane, Inc.
   f. M&H Valve Company; a division of McWane, Inc.
   g. Mueller Co.; Water Products Division.
   h. U.S. Pipe.
2. Description: Sleeve and valve compatible with drilling machine.
3. Standard: MSS SP-60.

B Tapping Sleeve: Cast-iron, ductile-iron, or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Sleeve shall match size and type of pipe material being tapped and have recessed flange for branch valve.

C Valve: AWWA, cast-iron, nonrising-stem, seated gate valve with one raised-face flange mating tapping-sleeve flange.

D 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 (125 mm) in diameter.

E Operating Wrenches: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

F Indicator Posts:

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. American AVK Company; Valves & Fittings Division.
   b. American Cast Iron Pipe Company; American Flow Control Division.
   c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   d. Clow Valve Company; a division of McWane, Inc.
   e. Crane Co.; Crane Valve Group; Stockham Division.
   f. Kennedy Valve; a division of McWane, Inc.
   g. Mueller Co.; Water Products Division.
   h. NIBCO INC.
   i. Tyco Fire & Building Products LP.
2. Description: Vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
3. Standards: UL 789 and "Approval Guide," published by FM Global, listing.

2.10 WATER METERS

A Water meters will be furnished by utility company.

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. AMCO Water Metering Systems.
b. Badger Meter, Inc.
c. Carlon Meter.
d. Hays Fluid Controls; a division of ROMAC Industries Inc.
e. McCrometer.
f. Mueller Co.; Hersey Meters Division.
g. Neptune Technology Group Inc.
h. Sensus Metering Systems.

B Displacement-Type Water Meters:
1. Description: With bronze main case.
2. Standard: AWWA C700.
3. Registration: Flow in gallons.

C Compound-Type Water Meters:
1. Standard: AWWA C702.
2. Registration: Flow in gallons.

D Remote Registration System:
1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
a. Standard: AWWA C706.
b. Registration: Flow in gallons.

E Remote Registration System:
1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
a. Standard: AWWA C707.
b. Registration: Flow in gallons.
c. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
d. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.11 WATER METER BOXES

A Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.

B Option: Base section may be cast-iron, PVC, clay, or other pipe.

2.12 CONCRETE VAULTS

A Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857, and made according to ASTM C 858.

B Ladder: ASTM A 36/A 36M, steel ladder; or PE-encased steel steps.

C Manhole: ASTM A 48/A 48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.
2. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
3. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

D Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.13 FIRE HYDRANTS

A AWWA Dry-Barrel Fire Hydrants:

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. American AVK Company; Valves & Fittings Division.
   b. American Cast Iron Pipe Company; American Flow Control Division.
   c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   d. American Foundry Group, Inc.
   e. Clow Valve Company; a division of McWane, Inc.
   f. East Jordan Iron Works, Inc.
   g. Kennedy Valve; a division of McWane, Inc.
   h. M&H Valve Company; a division of McWane, Inc.
   i. Mueller Co.; Water Products Division.
   j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
   k. U.S. Pipe.
2. Description: Post type, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets; and with 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body and compression-type valve opening against pressure and closing with pressure.
3. Standard: AWWA C502.
4. Pressure Rating: 200 psig minimum.

B UL-Listed, Dry-Barrel Fire Hydrants:

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. American Cast Iron Pipe Company; American Flow Control Division.
   b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   c. American Foundry Group, Inc.
   d. Clow Valve Company; a division of McWane, Inc.
   e. East Jordan Iron Works, Inc.
   f. Kennedy Valve; a division of McWane, Inc.
   g. M&H Valve Company; a division of McWane, Inc.
   h. Mueller Co.; Water Products Division.
   i. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
   j. U.S. Pipe.
2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets; and with 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body and compression-type valve opening against pressure and closing with pressure.
3. Standards: UL 246 and "Approval Guide," published by FM Global, listing.
4. Design: Base valve.
5. Pressure Rating: 200 psig minimum.
6. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

7. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
8. Direction of Opening: Hydrant valve opens by turning operating nut to left or counterclockwise.
9. Exterior Finish: Red alkyd-gloss enamel paint unless otherwise indicated.

C AWWA Wet-Barrel Fire Hydrants:

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. American AVK Company; Valves & Fittings Division.
   b. Clow Valve Company; a division of McWane, Inc.
   c. Jones, James Company.
   d. Mueller Co.; Water Products Division.
2. Description: Post type, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets and with NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550.
3. Standard: AWWA C503.
4. Pressure Rating: 200 psig minimum.

D UL-Listed, Wet-Barrel Fire Hydrants:

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. American AVK Company; Valves & Fittings Division.
   b. Clow Valve Company; a division of McWane, Inc.
   c. Jones, James Company.
   d. Mueller Co.; Water Products Division.
2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets and with NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.
3. Standards: UL 246 and "Approval Guide," published by FM Global, listing.
4. Design: Wet barrel.
5. Pressure Rating: 200 psig.
6. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
7. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
8. Direction of Opening: Hydrant valves open by turning operating nut to left or counterclockwise.
9. Exterior Finish: Red alkyd-gloss enamel paint unless otherwise indicated.

2.14 FIRE-DEPARTMENT CONNECTIONS

A 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]:

1. Elkhart Brass Mfg. Company, Inc.
2. Fire-End & Croker Corporation.
3. Guardian Fire Equipment, Inc.
4. Kidde Fire Fighting.
5. Potter Roemer.
6. Reliable Automatic Sprinkler Co., Inc.

B Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire-department hose threads, and threaded

bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.

C Standard: UL 405.
D Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
E Connections: Three NPS 2-1/2 (DN 65) inlets and one NPS 6 outlet.
F Connections: Six NPS 2-1/2 inlets and one NPS 6 outlet.
G Inlet Alignment: Inline, horizontal].
H Finish Including Sleeve: Polished bronze.
I Escutcheon Plate Marking: "AUTO SPKR."

2.15 ALARM DEVICES

A General: UL 753 and "Approval Guide," published by FM Global, listing, of types and sizes to mate and match piping and equipment.
B Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
C Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
D Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

2.16 SLEEVES

A Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
B Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
C Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard-weight, zinc-coated, plain ends.

2.17 SLEEVE SEALS

A 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]:
1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.
B Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
C 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.
D Pressure Plates: Stainless steel.
E Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.18 GROUT

A Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
B Characteristics: Nonshrink; recommended for interior and exterior applications.
1. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
2. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 EARTHWORK

A Comply with excavating, trenching, and backfilling requirements in Division 31 Section "Earth Moving."

3.02 PIPING INSTALLATION

A Water-Main Connection: Arrange with water 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 (DN 50) 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.
5. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
6. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
7. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
8. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
9. Install corporation valves into service-saddle assemblies.
10. Install manifold for multiple taps in water main.
11. Install curb valve in water-service piping with head pointing up and with service box.

D Comply with NFPA 24 for fire-service-main piping materials and installation.

E Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F Install encasement for tubing according to ASTM A 674 or AWWA C105.

G Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

H Install encasement for piping according to ASTM A 674 or AWWA C105.

I Bury piping with depth of cover over top at least 36 inches , with top at least 12 inches below level of maximum frost penetration.

J Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

K Terminate fire-suppression water-service piping at building floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

L 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.

M Comply with requirements in Division 21 Sections for fire-suppression-water piping inside the building.

N Comply with requirements in Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.03 JOINT CONSTRUCTION

A Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B Install unions adjacent to each valve in tubing NPS 2 (DN 50) and smaller.

C Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D Ream ends of tubes and remove burrs.

E Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

G Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

H Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

I Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

J Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.04 ANCHORAGE INSTALLATION

A Anchorage, General: Install water-distribution piping with restrained joints.

B Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.05 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 UL-Listed or FM-Approved 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.

C MSS Valves: Install as component of connected piping system.

D Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

E Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Division 03 Section

3.06 WATER METER INSTALLATION

A Install water meters, piping, and specialties according to utility company's written instructions.

B Water Meters: Install displacement-type water meters NPS 2 (DN 50) and smaller in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets, and include valved bypass around meters unless prohibited by authorities having jurisdiction.

C Water Meters: Install compound-type water meters NPS 3 (DN 80) and larger in meter vaults. Include shutoff valves on water meter inlets and outlets, and include valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D Support water meters and piping NPS 3 (DN 80) and larger on concrete piers. Comply with requirements for concrete piers in Division 03 Section

3.07 ROUGHING-IN FOR WATER METERS

A Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.08 WATER METER BOX INSTALLATION

A Install water meter boxes in paved areas flush with surface.

B Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.09 CONCRETE VAULT INSTALLATION

A Install precast concrete vaults according to ASTM C 891.

3.10 FIRE HYDRANT INSTALLATION

A General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C AWWA Fire Hydrants: Comply with AWWA M17.

D UL-Listed or FM-Approved Fire Hydrants: Comply with NFPA 24.

3.11 FIRE-DEPARTMENT CONNECTION INSTALLATION

A Install ball drip valves at each check valve for fire-department connection to mains.

B Install protective pipe bollards on three sides of each fire-department connection. Pipe bollards are specified in Division 05 Section "Metal Fabrications."

3.12 ALARM DEVICE INSTALLATION

A General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B Supervisory Switches: Supervise valves in open position.

C Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

D Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

E Locking and Sealing: Secure unsupervised valves as follows:

F Valves: Install chain and padlock on open OS&Y gate valve.

G Post Indicators: Install padlock on wrench on indicator post.

H Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

I Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

J Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Division 28 Sections.

3.13 CONNECTIONS

A Connect fire-suppression water-service piping to [utility water main] [existing water main] <Insert piping system>. Use [tapping sleeve and tapping valve] [service clamp and corporation valve] <Insert method>.

B Connect fire-suppression water-service piping to interior fire-suppression piping.

C Connect waste piping from concrete vault drains to [sanitary sewerage system. Comply with requirements in Division 22 Section "Facility Sanitary Sewers" for connection to sanitary sewer] [storm-drainage system. Comply with

requirements in Division 33 Section "Storm Utility Drainage Piping" for connection to storm sewer].

3.14 SLEEVE INSTALLATION

A General Requirements: Install sleeves for pipes and tubes passing through penetrations in exterior walls.

B Exception: Sleeves are not required for core-drilled holes.

C Cut sleeves to length for mounting flush with both surfaces.

D Install sleeves in new floor slabs and walls as they are constructed.

E For exterior wall penetrations above grade, seal annular space between sleeves and piping using [joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."] [sleeve seals.]

F For exterior wall penetrations below grade, seal annular space between sleeves and piping using sleeve seals.

G Seal space outside of sleeves in concrete walls with grout.

H Install the following sleeve materials:

1. Galvanized- steel pipe or steel-sheet sleeves for pipes smaller than NPS 6 (DN 150).
2. Cast-iron wall-pipe or galvanized-steel pipe sleeves for pipes NPS 6 (DN 150).

3.15 SLEEVE SEAL INSTALLATION

A Install sleeve seals in sleeves in exterior concrete floor slabs and walls at fire-suppression water-service piping entries into the building.

B Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.16 FIELD QUALITY CONTROL

A Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B 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.

C Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

D Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

E Prepare test and inspection reports.

3.17 IDENTIFICATION

A Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

B Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.18 CLEANING

A Clean and disinfect fire-suppression water-service piping as follows:

B Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.

C 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.

D 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:

E 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.

F 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 three hours.

G After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

H Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

I Prepare reports of purging and disinfecting activities.

3.19 PIPING SCHEDULE

A Underground fire-suppression water-service piping NPS 2 (DN 50) and smaller shall be hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

B Underground and underslab fire-suppression water-service piping NPS 3 to NPS 6 (DN 80 to DN 150) shall be one of the following:

C Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

D Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

E Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.

F Meter box fire-suppression water-service piping NPS 2 and smaller shall be hard copper tube, ASTM B 88, Type L; wrought- or cast-copper-alloy, solder-joint fittings; and brazed joints.

G Vault fire-suppression water-service piping NPS 3 to NPS 6 (DN 80 to DN 150) shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

3.20 VALVE SCHEDULE

A Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

B Underground fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be corporation valves or curb valves with ends compatible with piping.

C Meter box fire-suppression water-service shutoff valvesNPS 2 (DN 50) and smaller shall be meter valves.

D Vault fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be Class 125, MSS, bronze, nonrising stem gate valves.

E Underground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, -seated gate valves.

2. 175-psig (1200-kPa), UL-listed or FM-approved, iron, nonrising-stem gate valves.

F Indicator-post underground fire-suppression water-service valves NPS 3 (DN 80) and larger shall be 175-psig (1200-kPa), UL-listed or FM-approved, iron, nonrising-stem gate valves with indicator-post flange.

G Standard-pressure, vault fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:

1. 200-psig (1380-kPa), AWWA, iron, OS&Y, seated gate valves.
2. 175-psig (1200-kPa), UL-listed or FM-approved, iron, OS&Y gate valves.

End

SECTION 211313

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A Section Includes:
1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Excess-pressure pumps.
6. Alarm devices.
7. Pressure gauges.

B Related Sections:
1. Division 21 Section "Fire-Suppression Standpipes" for standpipe piping.

1.02 SYSTEM DESCRIPTIONS

A Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.03 PERFORMANCE REQUIREMENTS

A Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C Available fire-hydrant flow test records indicate the following conditions:
1. Date: May 18, 2007.
2. Time: 9:00 am
3. Performed by: Ingram & Associates, LLC
4. Static Pressure at Residual Fire Hydrant R: 148 psig.
5. Measured Flow at Flow Fire Hydrant F: 1350
6. Residual Pressure at Residual Fire Hydrant R: 65 psig

D Sprinkler system design shall be approved by authorities having jurisdiction.

E Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.

F Sprinkler Occupancy Hazard Classifications:

G See sprinkler system design schedule sheet P0.1

1.04 SUBMITTALS

A Product Data: For each type of product indicated.

B Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
2. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Qualification Data: For qualified Installer and professional engineer.
4. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

a. Welding certificates.

5. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
6. Field quality-control reports.
7. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

B Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

C Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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 NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.02 STEEL PIPE AND FITTINGS

A Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M,. Pipe ends may be factory or field formed to match joining method.

B Schedule 30, Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.

E Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

F Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

G Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

H Malleable- or Ductile-Iron Unions: UL 860.

I Cast-Iron Flanges: ASME 16.1, Class 125.
J Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
K Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
L Grooved-Joint, Steel-Pipe Appurtenances:
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. Anvil International, Inc.
b. Corcoran Piping System Co.
c. National Fittings, Inc.
d. Shurjoint Piping Products.
e. Tyco Fire & Building Products LP.
f. Victaulic Company.
2. Pressure Rating 250 psig minimum.
M Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
N Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
O Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
P 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:
1. Victaulic Company.

2.03 PIPING JOINING MATERIALS
A Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
B Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.
C Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
D Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 LISTED FIRE-PROTECTION VALVES
A General Requirements:
1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
B Check Valves:
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. AFAC Inc.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Anvil International, Inc.
d. Clow Valve Company; a division of McWane, Inc.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Crane Co.; Crane Valve Group; Stockham Division.
h. Fire-End & Croker Corporation.

i. Fire Protection Products, Inc.
j. Fivalco Inc.
k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Shurjoint Piping Products.
v. Tyco Fire & Building Products LP.
w. United Brass Works, Inc.
x. Venus Fire Protection Ltd.
y. Victaulic Company.
z. Viking Corporation.
aa. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

C Bronze OS&Y Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.
2. Standard: UL 262.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Bronze.

D Iron OS&Y Gate Valves:

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. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   b. American Valve, Inc.
   c. Clow Valve Company; a division of McWane, Inc.
   d. Crane Co.; Crane Valve Group; Crane Valves.
   e. Crane Co.; Crane Valve Group; Jenkins Valves.
   f. Crane Co.; Crane Valve Group; Stockham Division.
   g. Hammond Valve.
   h. Milwaukee Valve Company.
   i. Mueller Co.; Water Products Division.
   j. NIBCO INC.
   k. Shurjoint Piping Products.
   l. Tyco Fire & Building Products LP.
   m. United Brass Works, Inc.

n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

E Indicating-Type Butterfly Valves:

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. Anvil International, Inc.
   b. Fivalco Inc.
   c. Global Safety Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Shurjoint Piping Products.
   h. Tyco Fire & Building Products LP.
   i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa) minimum.

F Valves NPS 2 (DN 50) and Smaller:

1. Valve Type: Ball or butterfly.
2. Body Material: Bronze.
3. End Connections: Threaded.

G Valves NPS 2-1/2 (DN 65) and Larger:

1. Valve Type: Butterfly.
2. Body Material: Cast or ductile iron.
3. End Connections: Flanged, grooved, or wafer.
4. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch electrical, indicating device.

2.05 TRIM AND DRAIN VALVES

A General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B Ball Valves:

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. Affiliated Distributors.
   b. Anvil International, Inc.
   c. Barnett.
   d. Conbraco Industries, Inc.; Apollo Valves.
   e. Fire-End & Croker Corporation.
   f. Fire Protection Products, Inc.
   g. Flowserve.
   h. FNW.
   i. Jomar International, Ltd.
   j. Kennedy Valve; a division of McWane, Inc.
   k. Kitz Corporation.
   l. Legend Valve.
   m. Metso Automation USA Inc.
   n. Milwaukee Valve Company.

o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.
r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

2.06 SPECIALTY VALVES

A General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
a. Minimum Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Cast or ductile iron.
c. Size: Same as connected piping.
d. End Connections: Flanged or grooved.

B Alarm Valves:
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. AFAC Inc.
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Tyco Fire & Building Products LP.
e. Venus Fire Protection Ltd.
f. Victaulic Company.
g. Viking Corporation.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.

C Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.

D Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

E Drip Cup Assembly: Pipe drain with check valve to main drain piping.

F Automatic (Ball Drip) Drain Valves:
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. AFAC Inc.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4 (DN 20).
6. End Connections: Threaded.

2.07 FIRE-DEPARTMENT CONNECTIONS

A Flush-Type, Fire-Department Connection:
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. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Finish: Polished chrome plated.
13. Outlet Size: NPS 4.

2.08 SPRINKLER SPECIALTY PIPE FITTINGS

A Branch Outlet Fittings:

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. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Shurjoint Piping Products.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.

B Branch Outlets: Grooved, plain-end pipe, or threaded.

C Flow Detection and Test Assemblies:

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. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D Branch Line Testers:
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. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer.
2. Standard: UL 199.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E Sprinkler Inspector's Test Fittings:
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. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
   e. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

F Adjustable Drop Nipples:
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. CECA, LLC.
   b. Corcoran Piping System Co.
   c. Merit Manufacturing; a division of Anvil International, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G Flexible, Sprinkler Hose Fittings:
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. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.

4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.09 SPRINKLERS

A 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]:
1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.
5. Automatic Sprinklers with Heat-Responsive Element:
6. Early-Suppression, Fast-Response Applications: UL 1767
7. Nonresidential Applications: UL 199 .
8. Residential Applications: UL 1626 .

C Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D Sprinkler Finishes:
1. Chrome plated.
2. Bronze.
3. Painted.

E Special Coatings:
1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat .
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G Sprinkler Guards:
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. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A Alarm-device types shall match piping and equipment connections.

B Water-Motor-Operated Alarm:

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. Globe Fire Sprinkler Corporation.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch (250-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
   a. Inlet: NPS 3/4 (DN 20).
   b. Outlet: NPS 1 (DN 25) drain connection.

C Water-Flow Indicators:

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. ADT Security Services, Inc.
   b. McDonnell & Miller; ITT Industries.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
   e. Viking Corporation.
   f. Watts Industries (Canada) Inc.
2. Standard: UL 346.

D Water-Flow Detector: Electrically supervised.

1. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
2. Type: Paddle operated.
3. Pressure Rating: 250 psig (1725 kPa).
4. Design Installation: Horizontal or vertical.

E Valve Supervisory Switches:

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. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAUGES

A 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:
1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B Standard: UL 393.

C Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D Pressure Gauge Range: 0 to 250 psig minimum.

E Water System Piping Gauge: Include "WATER" or "AIR/WATER" label on dial face.

F Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.12 ESCUTCHEONS

A General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.

C One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.

D One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.

E Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated finish with concealed hinge and set-screw.

F Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed exposed-rivet]hinge, set-screw or spring clips.

G One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H Split-Casting Floor Plates: Cast brass with concealed hinge.

2.13 SLEEVES

A Wall-pipe sleeves in first paragraph below are available with many end variations.

B Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

C Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

E Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

G Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

H Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

I Underdeck Clamp: Clamping ring with set-screws.

2.14 SLEEVE SEALS

A 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:
1. Advance Products & Systems, Inc.
2. Calpico, Inc.

3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.

B Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

C 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.

D Pressure Plates: Stainless steel.

E Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.15 GROUT

A Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.

B Characteristics: Nonshrink, and recommended for interior and exterior applications.

C Design Mix: 5000-psi (34-MPa), 28-day compressive strength.

D Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 SERVICE-ENTRANCE PIPING

A Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."

B Install shutoff valve,[backflow preventer,] pressure gauge, drain, and other accessories indicated at connection to water-service piping.[Comply with requirements for backflow preventers in Division 21 Section "Facility Fire-Suppression Water-Service Piping."]

C Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.02 WATER-SUPPLY CONNECTIONS

A Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping."

B Install shutoff valve,[backflow preventer,] pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.[Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties."]

C Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

B Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

D Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

E Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
F Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
G Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
H Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
I Install sprinkler piping with drains for complete system drainage.
J Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
K Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
L Install alarm devices in piping systems.
M Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
N Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.
O Fill sprinkler system piping with water.
P Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Division 21 Section "Fire-Suppression Systems Insulation."

3.04 JOINT CONSTRUCTION

A Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
B Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
C Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
D Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
E Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
F Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
G 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.
H Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
I Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

K Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

L Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

M Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

N Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

O Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

E Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.06 SPRINKLER INSTALLATION

A Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.07 FIRE-DEPARTMENT CONNECTION INSTALLATION

A Install wall-type, fire-department connections.

B Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.08 ESCUTCHEON INSTALLATION

A Install escutcheons for penetrations of walls, ceilings, and floors.

B Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish stamped steel with set-screw or spring clips.

3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish .
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish stamped steel with set-screw or spring clips.
5. Bare Piping in Equipment Rooms: One piece, cast brass stamped steel with set-screw or spring clips.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.09 SLEEVE INSTALLATION

A General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
B Sleeves are not required for core-drilled holes.
C Permanent sleeves are not required for holes formed by removable PE sleeves.
D Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
E Install sleeves in new partitions, slabs, and walls as they are built.
F For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
G For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
H For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
I Seal space outside of sleeves in concrete slabs and walls with grout.
J Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
K Install sleeve materials according to the following applications:
L Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
M Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
N Extend sleeves 2 inches above finished floor level.
O For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
P Sleeves for Piping Passing through Gypsum-Board Partitions:
Q PVC-pipe leeves for pipes smaller than NPS 6 (DN 150).
R Galvanized-steel-sheet leeves for pipes NPS 6 (DN 150) and larger.
S Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
T Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
U Sleeves for Piping Passing through Exterior Concrete Walls:
V Galvanized-steel-pipe leeves for pipes smaller than NPS 6.
W Cast-iron wall-pipe sleeves for pipes NPS 6 and larger.
X Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
Y Sleeves for Piping Passing through Interior Concrete Walls:
Z Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 .

AA Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.

BB 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.10 SLEEVE SEAL INSTALLATION

A Sleeve seals in this article are used in exterior concrete and masonry walls for a watertight seal around water-service piping entries into the building. These seals typically require installation in a sleeve for proper operation.

B Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

C Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

A Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.12 FIELD QUALITY CONTROL

A Perform tests and inspections.

B Tests and Inspections:

1. Leak Test: After installation, charge systems 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run excess-pressure pumps.
   a. Coordinate with fire-alarm tests. Operate as required.
   b. Coordinate with fire-pump tests. Operate as required.
   c. Verify that equipment hose threads are same as local fire-department equipment.
6. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
7. Prepare test and inspection reports.

3.13 CLEANING

A Clean dirt and debris from sprinklers.

B Remove and replace sprinklers with paint other than factory finish.

3.14 PIPING SCHEDULE

A Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with [threaded ends; cast-iron threaded fittings; and threaded] [grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved] joints.

B Sprinkler specialty fittings may be used, downstream of control vales, instead of specified fittings.

C Wet-pipe sprinkler system, NPS 2 and smaller shall be one of the following:

D Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
E Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
F Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
G Standard-weight], black-steel pipe with plain ends; steel welding fittings; and welded joints.
H Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
I Thinwall black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
J Thinwall black-steel pipe with plain ends; welding fittings; and welded joints.
K Schedule 5 steel pipe; steel pressure-seal fittings; and pressure-sealed joints.
L Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6 shall be one of the following:
M Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
N Standard-weight, black-steel pipe with cut- or][roll- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
O Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
P Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
Q Thinwall black-steel pipe with plain ends; welding fittings; and welded joints.

3.15 SPRINKLER SCHEDULE
A Use sprinkler types in subparagraphs below for the following applications:
B See sprinkler design criteria schedule sheet P0.1.

End

SECTION 211316

DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinkler specialty pipe fittings.
5. Sprinklers.
6. Alarm devices.
7. Pressure gauges.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Standpipes" for standpipe piping.
2. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

1.02 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.03 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified state licensed professional (engineer or contractor as required by the state in which the project is located), using performance requirements and design criteria indicated on drawings and in specifications.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications: See schedule on drawings.
3. Minimum Density for Automatic-Sprinkler Piping Design: See schedule on drawings.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

G. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Galvanized-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized, Steel Couplings: ASTM A 865, threaded.

F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME B16.1, Class 125.

I. Grooved-Joint, 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, Inc.
    b. Corcoran Piping System Co.
    c. National Fittings, Inc.
    d. Shurjoint Piping Products.
    e. Tyco Fire & Building Products LP.
    f. Victaulic Company.

2. Pressure Rating: 250 psig (1725 kPa) minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.04 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. 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:

a. AFAC Inc.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Anvil International, Inc.
d. Clow Valve Company; a division of McWane, Inc.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Crane Co.; Crane Valve Group; Stockham Division.
h. Fire-End & Croker Corporation.
i. Fire Protection Products, Inc.
j. Fivalco Inc.
k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Shurjoint Piping Products.
v. Tyco Fire & Building Products LP.
w. United Brass Works, Inc.
x. Venus Fire Protection Ltd.
y. Victaulic Company.
z. Viking Corporation.
aa. Watts Water Technologies, Inc.

2. Standard: UL 312
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Type: Swing check.
5. Body Material: Cast iron.

6. End Connections: Flanged or grooved.

C. Bronze OS&Y 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; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. United Brass Works, Inc.

2. Standard: UL 262.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron OS&Y 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 Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Hammond Valve.
h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.
m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

E. Indicating-Type 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:

a. Anvil International, Inc.
b. Fivalco Inc.
c. Global Safety Products, Inc.
d. Kennedy Valve; a division of McWane, Inc.

e. Milwaukee Valve Company.
f. NIBCO INC.
g. Shurjoint Piping Products.
h. Tyco Fire & Building Products LP.
i. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Valves NPS 2 (DN 50) and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

5. Valves NPS 2-1/2 (DN 65) and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch visual indicating device.

2.05 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. 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:

a. Affiliated Distributors.
b. Anvil International, Inc.
c. Barnett.
d. Conbraco Industries, Inc.; Apollo Valves.
e. Fire-End & Croker Corporation.
f. Fire Protection Products, Inc.
g. Flowserve.
h. FNW.
i. Jomar International, Ltd.
j. Kennedy Valve; a division of McWane, Inc.
k. Kitz Corporation.
l. Legend Valve.
m. Metso Automation USA Inc.
n. Milwaukee Valve Company.
o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.

r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

2.06 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Dry-Pipe 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. AFAC Inc.
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Tyco Fire & Building Products LP.
e. Venus Fire Protection Ltd.
f. Victaulic Company.
g. Viking Corporation.

2. Standard: UL 260
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
5. Air Compressor:

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) Gast Manufacturing Inc.
2) General Air Products, Inc,
3) Viking Corporation.

b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
c. Power: 120-V ac, 60 Hz, single phase.

2.07 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

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. AFAC Inc.
    b. Elkhart Brass Mfg. Company, Inc.
    c. GMR International Equipment Corporation.
    d. Guardian Fire Equipment, Inc.
    e. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal unless otherwise indicated on architectural plans
11. Number of Inlets: Two.
12. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE” or “AUTO SPKR" as appropriate for project.
13. Finish: Polished chrome plated.

2.08 SPRINKLER SPECIALTY PIPE FITTINGS

A. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.

B. Branch Outlet 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:

    a. Anvil International, Inc.
    b. National Fittings, Inc.
    c. Shurjoint Piping Products.
    d. Tyco Fire & Building Products LP.
    e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test 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:

    a. AGF Manufacturing Inc.
    b. Reliable Automatic Sprinkler Co., Inc.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

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. Elkhart Brass Mfg. Company, Inc.
    b. Fire-End & Croker Corporation.
    c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test 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:

    a. AGF Manufacturing Inc.
    b. Triple R Specialty.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

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. CECA, LLC.
    b. Corcoran Piping System Co.
    c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible, Sprinkler Hose 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:

    a. Fivalco Inc.
    b. FlexHead Industries, Inc.
    c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Size: Same as connected piping, for sprinkler.

2.09 SPRINKLERS

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. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Residential Applications: UL 1626.
3. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with discharge coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

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. Globe Fire Sprinkler Corporation.
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch (250-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: NPS 1 (DN 25) drain connection.

C. Valve Supervisory Switches:

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. Fire-Lite Alarms; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAUGES

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. AMETEK, Inc.; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gauge Range: 0 to 250 psig (0 to 1725 kPa) minimum.

E. Water System Piping Gauge: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.01 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, backflow preventer (if indicated on plans), pressure gauge, drain, and other accessories indicated at connection to water-service piping.

3.02 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements in Division 22 Section "Domestic Water Piping" for interior piping.

B. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.

M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.

N. Drain dry-pipe sprinkler piping.

O. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

    a. Install air compressor and compressed-air supply piping.

3.06 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.07 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.11 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control vales, instead of specified fittings.

C. Dry-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Dry-pipe sprinkler system, NPS 2-1/2 to NPS 6 (DN 65 to DN 150), shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in specific areas as indicated on plans and schedules on drawings.

END OF SECTION 211316

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 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. Equipment installation requirements common to equipment sections.
8. Concrete bases.
9. Supports and anchorages.

1.02 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.

1.03 SUBMITTALS

A. Welding certificates.

1.04 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."

C. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

D. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

E. 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

2.01 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.

2.02 JOINING MATERIALS
A Refer to individual Division 22 piping Sections for special joining materials not listed below.
B Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
C Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
D Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
E Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
F Welding Filler Metals: Comply with AWS D10.12.
G Solvent Cements for Joining Plastic Piping:
1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.03 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 minimum working pressure at 225 deg F.

2.04 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, NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
C Pressure Plates: Plastic, Carbon steel, Stainless steel. Include two for each sealing element.
D Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 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.

E Underdeck Clamp: Clamping ring with set screws.
F Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
G PVC Pipe: ASTM D 1785, Schedule 40.
H Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 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.
D Finish: Polished chrome-plated, Polished chrome-plated and rough brass.
E Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
F Finish: Polished chrome-plated, Polished chrome-plated and rough brass.

2.07 GROUT
A Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
B Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
C Design Mix: 5000-psi, 28-day compressive strength.
D Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 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.
O Install steel pipe for sleeves smaller than 6 inches in diameter.

P Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

Q 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.

R 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.

S 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.

T 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.

U Verify final equipment locations for roughing-in.

V Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 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 Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
7. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
8. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
9. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.
    c. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A Make connections according to the following, unless otherwise indicated:

B Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

C Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

D Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

E Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 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.

3.05 CONCRETE BASES

A Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

B Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

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 the base.

D Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

E Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

F Install anchor bolts to elevations required for proper attachment to supported equipment.

G Install anchor bolts according to anchor-bolt manufacturer's written instructions.
H Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete Miscellaneous Cast-in-Place Concrete."

3.06 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.

3.07 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.

3.08 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

SECTION 220519

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY
- A Section Includes:
  1. Bimetallic-actuated thermometers.
  2. Thermowells.
  3. Dial-type pressure gauges.
  4. Gauge attachments.

1.02 SUBMITTALS
- A Product Data: For each type of product indicated.
- B Product certificates.
- C Operation and maintenance data.

PART 2 PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS
- A 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:
  1. Ashcroft Inc.
  2. Ernst Flow Industries.
  3. Marsh Bellofram.
  4. Miljoco Corporation.
  5. Nanmac Corporation.
  6. Noshok.
  7. Palmer Wahl Instrumentation Group.
  8. REOTEMP Instrument Corporation.
  9. Tel-Tru Manufacturing Company.
  10. Trerice, H. O. Co.
  11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  12. Weiss Instruments, Inc.
  13. WIKA Instrument Corporation - USA.
  14. Winters Instruments - U.S.
- B Standard: ASME B40.200.
- C Case: sealed type(s); stainless steel with 5-inch nominal diameter.
- D Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F Connector Size: 1/2 inch , with ASME B1.1 screw threads.
- G Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H Window: Plain glass.
- I Ring: Stainless steel.
- J Element: Bimetal coil.
- K Pointer: Dark-colored metal.
- L Accuracy: Plus or minus 1 percent of scale range.

2.02 THERMOWELLS
- A Thermowells:
  1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into

piping tee fitting.

3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES, CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
12. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAUGES

A Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:

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. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed, Solid-front, pressure relief type(s); cast aluminum or drawn steel 4-1/2-inch , 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS ½, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B Direct-Mounted, Plastic-Case, Dial-Type Pressure Gauges:

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. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Flo Fab Inc.
d. Marsh Bellofram.
e. Miljoco Corporation.
f. Noshok.
g. Palmer Wahl Instrumentation Group.
h. REOTEMP Instrument Corporation.
i. Tel-Tru Manufacturing Company.
j. Trerice, H. O. Co.
k. Weiss Instruments, Inc.
l. WIKA Instrument Corporation - USA.
m. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch or 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

C Remote-Mounted, Metal-Case, Dial-Type Pressure Gauges:

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. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Ernst Flow Industries.
d. Flo Fab Inc.
e. Marsh Bellofram.
f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type; cast aluminum or drawn steel, metal; 4-1/2-inch or 6-inch nominal diameter with back or front flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS ¼ or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings

graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Stainless steel .
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

D Remote-Mounted, Plastic-Case, Dial-Type Pressure Gauges:
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. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Miljoco Corporation.
d. Noshok.
e. Palmer Wahl Instrumentation Group.
f. REOTEMP Instrument Corporation.
g. Tel-Tru Manufacturing Company.
h. Trerice, H. O. Co.
i. Weiss Instruments, Inc.
j. WIKA Instrument Corporation - USA.
k. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch or 6-inch (152-mm) nominal diameter with back or front flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAUGE ATTACHMENTS
A Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
B Valves: Brass ball, Brass or stainless-steel needle, NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 EXECUTION

3.01 INSTALLATION
A Install thermowells with socket extending a minimum of 2 inches into fluid one-third of pipe diameter to center of pipe and in vertical position in piping tees.
B Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
C Install thermowells with extension on insulated piping.
D Fill thermowells with heat-transfer medium.
E Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
F Install remote-mounted thermometer bulbs in thermowells and install cases on

panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

H Install remote-mounted pressure gauges on panel.

I Install valve and snubber in piping for each pressure gauge for fluids.

J Install thermometers in the following locations:
1. Inlet and outlet of each water heater.
2. Inlet and outlet of each thermostatic mixing valve.
3. Inlet and outlet of each remote domestic water chiller.

K Install pressure gauges in the following locations:
1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

L Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

M Adjust faces of meters and gauges to proper angle for best visibility.

3.02 THERMOMETER SCHEDULE

A Thermometers at inlet and outlet of each domestic water heater shall be the following:
1. Sealed, bimetallic-actuated type.

B Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
1. Sealed, bimetallic-actuated type.

C Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
1. Sealed, bimetallic-actuated type.

D Thermometers at inlet and outlet of each remote domestic water chiller shall be the following:
1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

E Thermometer stems shall be of length to match thermowell insertion length.

3.03 THERMOMETER SCALE-RANGE SCHEDULE

A Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

C Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.04 PRESSURE-GAUGE SCHEDULE

A Pressure gauges at discharge of each water service into building shall be the following:
1. Sealed Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

B Pressure gauges at inlet and outlet of each water pressure-reducing valve shall be the following:
1. Sealed Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

C Pressure gauges at suction and discharge of each domestic water pump shall be the following:
1. Sealed Solid-front, pressure-relief, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

3.05 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

A Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.

B Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

End

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 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.
8. Bronze globe valves.

B. Related Sections:
1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.02 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.03 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

2.01 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. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. Gate Valves: With rising stem.
2. 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.

F. Butterfly Valves: With extended neck.

G. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.02 BRASS BALL VALVES

A Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

B 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:
1. Crane Co.; Crane Valve Group; Crane Valves.
2. Crane Co.; Crane Valve Group; Jenkins Valves.
3. DynaQuip Controls.
4. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
5. Hammond Valve.
6. Jamesbury; a subsidiary of Metso Automation.
7. Jomar International, LTD.
8. Kitz Corporation.
9. Legend Valve.
10. Marwin Valve; a division of Richards Industries.
11. Milwaukee Valve Company.
12. NIBCO INC.
13. Red-White Valve Corporation.
14. RuB Inc.

C Description:
1. Standard: MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Threaded.
7. Seats: PTFE or TFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.

2.03 BRONZE BALL VALVES

A Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
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. 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.

2.04 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, 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. 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, 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. 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, 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. 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, 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. 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: NBR.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Nickel-plated or -coated ductile iron.

2.05 BRONZE SWING CHECK VALVES

A Class 125, Bronze Swing Check Valves with Bronze Disc:

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. 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.
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, 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. 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.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.06 IRON SWING CHECK VALVES

A Class 125, Iron Swing Check Valves with Metal Seats:

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. 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, 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. 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.

2.07 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

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. NIBCO INC.
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: Bronze.
   g. Gasket: Asbestos free.
   h. Closure Control: Factory-installed, exterior lever and spring.

2.08 BRONZE GATE VALVES

A Class 125, NRS Bronze Gate Valves:

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. 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, 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. 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.

2.09 IRON GATE VALVES

A Class 125, NRS, Iron Gate Valves:

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. 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, 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. 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.

2.10 BRONZE GLOBE VALVES

A Class 125, Bronze Globe Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.

h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
j. 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 and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

B Class 125, Bronze Globe Valves with Nonmetallic Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.

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: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.01 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 swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.02 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.

3.03 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: Ball or butterfly valves.

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:

D For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
E For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
F For Copper Tubing, NPS 5 and Larger: Flanged ends.
G For Steel Piping, NPS 2 and Smaller: Threaded ends.
H For Steel Piping, NPS 2-1/2 to NPS 4 : Flanged ends except where threaded valve-end option is indicated in valve schedules below.
I For Steel Piping, NPS 5 and Larger: Flanged ends.

3.04 DOMESTIC, HOT- AND COLD-WATER 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. Bronze Angle Valves: Class 125, bronze nonmetallic disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass or bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze nonmetallic disc.
5. Bronze Gate Valves: Class 125, NRS RS.
6. Bronze Globe Valves: Class 125, bronze nonmetallic disc.

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 NBR seat, aluminum-bronze ductile-iron disc.
3. Iron Swing Check Valves: Class 125, metal nonmetallic-to-metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
5. Iron Gate Valves: Class 125, NRS OS&Y.

3.05 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: Two piece, full port, brass or bronze with brass or bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze nonmetallic disc.
4. Bronze Gate Valves: Class 125, NRS RS.
5. Bronze Globe Valves: Class 125, bronze nonmetallic disc.

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 Swing Check Valves: Class 125, metal nonmetallic-to-metal seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
4. Iron Gate Valves: Class 125, NRS OS&Y.

End

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 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.

C See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.

1.02 DEFINITIONS

A Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 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.

1.04 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: 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.
4. Welding certificates.

1.05 QUALITY ASSURANCE

A Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

B 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.

C Manufacturers: Subject to compliance with requirements, provide products by

one of the manufacturers specified.

2.02 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.

2.03 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.

2.04 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.

2.05 THERMAL-HANGER SHIELD INSERTS

A Description: 100-psig- 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 Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass ASTM C 552, Type II cellular glass with vapor barrier.

D Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass ASTM C 552, Type II cellular glass.

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 beyond sheet metal shield for piping operating below ambient air temperature.

2.06 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 Available Manufacturers:
1. Hilti, Inc.
2. ITW Ramset/Red Head.
3. Masterset Fastening Systems, Inc.
4. MKT Fastening, LLC.
5. Powers Fasteners.

C Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

D Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Empire Industries, Inc.
3. Hilti, Inc.
4. ITW Ramset/Red Head.
5. MKT Fastening, LLC.
6. Powers Fasteners.

2.07 EQUIPMENT SUPPORTS

A Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.08 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.

C Properties: Nonstaining, noncorrosive, and nongaseous.

D Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01 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.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, ith 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 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
9. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
    b. 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.

G Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

H Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

I Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

J Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

K Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

L Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

M Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

N Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

O Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

P C-Clamps (MSS Type 23): For structural shapes.

Q 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:

1. Light (MSS Type 31): 750 lb.
2. Medium (MSS Type 32): 1500 lb.
3. Heavy (MSS Type 33): 3000 lb.

R Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

S Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

T Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
U Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
V Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
W Thermal-Hanger Shield Inserts: For supporting insulated pipe.
X Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
Y Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
Z Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
AA 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.
BB Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
CC Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
DD Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 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.
C 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.
D Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
E Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
F Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
G Fastener System Installation:
1. Install powder-actuated fasteners 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.
3. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
H Equipment Support Installation: Fabricate from welded-structural-steel shapes.
1. 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.
2. Install lateral bracing with pipe hangers and supports to prevent swaying.
3. 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.

I Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J 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.

K Insulated Piping: Comply with the following:

L Attach clamps and spacers to piping.

M Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

N Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

O Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

P Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

Q Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

R Shield Dimensions for Pipe: Not less than the following:

1. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
2. NPS 4: 12 inches long and 0.06 inch thick.
3. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
4. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
5. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
6. Pipes NPS 8 and Larger: Include wood inserts.
7. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 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.

3.04 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 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

D Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

E Obtain fusion without undercut or overlap.

F Remove welding flux immediately.

G Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 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.

B Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

C Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

End

SECTION 220533

HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:
   1. Plastic insulated, series resistance.
   2. Self-regulating, parallel resistance.
B. See Division 21 Section "Heat Tracing for Fire-Suppression Piping."
C. See Division 23 Section "Heat Tracing for HVAC Piping."

1.02 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
   1. Wiring Diagrams: Power, signal, and control wiring.
C. Field quality-control test reports.
D. Operation and maintenance data.
E. Warranty: Special warranty specified in this Section.

1.03 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.

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING 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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
   1. BH Thermal Corporation.
   2. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
   3. Delta-Therm Corporation.
   4. Easy Heat Inc.
   5. Nelson Heat Trace.
   6. Pyrotenax; a division of Tyco Thermal Controls.
   7. Raychem; a division of Tyco Thermal Controls.
   8. Thermon Manufacturing Co.
   9. Trasor Corp.

D. Heating Element: Pair of parallel No. 16 AWG, tinned, stranded copper bus wires embedded in cross-linked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled non-heating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

E. Electrical Insulating Jacket: Flame-retardant polyolefin.

F. Cable Cover: polyolefin outer jacket with UV inhibitor.

G. Maximum Operating Temperature (Power On): 150 deg F.

H. Maximum Exposure Temperature (Power Off): 185 deg F.

I. Maximum Operating Temperature: 300 deg F.

J. Capacities and Characteristics:
   1. Maximum Heat Output: 5 W/ft.
   2. Piping Diameter: 4 inch NPS.
   3. Number of Parallel Cables: As Necessary.
   4. Spiral Wrap Pitch: As Necessary.
   5. Volts: 120 V.
   6. Phase: Single.
   7. Hertz: 60 Hz.
   8. Full-Load Amperes: As Necessary.
   9. Minimum Circuit Ampacity: 20 A.
   10. Maximum Overcurrent Protection: 20 A.

2.02 CONTROLS

A. Pipe-Mounting Thermostats for Freeze Protection:
   1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
   2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
   3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
   4. Corrosion-resistant, waterproof control enclosure.

2.03 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Division 22 Section "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
   1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

PART 3 EXECUTION

3.01 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:
   1. Freeze Protection for Piping: Self-regulating, parallel-resistance heating cable.
   2. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

3.02 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.
B. Electric Heating Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.
C. Electric Heating Cable Installation for Freeze Protection for Piping:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install electric heating cables according to IEEE 515.1.
   3. Install insulation over piping with electric cables according to Division 22 Section "Plumbing Insulation."
   4. Install warning tape on piping insulation where piping is equipped with electric heating cables.
D. Electric Heating Cable Installation for Temperature Maintenance for Domestic Hot Water:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install insulation over piping with electric heating cables according to Division 22 Section "Plumbing Insulation."
   3. Install warning tape on piping insulation where piping is equipped with electric heating cables.
E. Set field-adjustable switches and circuit-breaker trip ranges.
F. Protect installed heating cables, including non-heating leads, from damage.
G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   1. Test cables for electrical continuity and insulation integrity before energizing.
   2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

C. Remove and replace malfunctioning units and retest as specified above.

END

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.02 SUBMITTAL

A Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A Metal Labels for Equipment:

B Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

C Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D 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.

E Fasteners: Stainless-steel rivets or self-tapping screws.

F Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
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 rivets or self-tapping screws self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H 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.

I Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.

2.02 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.

1. Letter Color: Yellow.
2. Background Color: Black.
3. Maximum Temperature: Able to withstand temperatures up to 180 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. 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.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
8. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.

B General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E 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.

F 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.

G Lettering Size: At least 1-1/2 inches high.

PART 3 EXECUTION

3.01 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.

3.02 EQUIPMENT LABEL INSTALLATION

A Install or permanently fasten labels on each major item of mechanical equipment.

B Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting High-Performance Coatings."

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.
8. Pipe Label Color Schedule:
   a. Domestic Water Piping:
      1) Background Color: White.
      2) Letter Color: Blue (cold water) Red (hot water).
   b. Sanitary Waste Piping:
      1) Background Color: Green.
      2) Letter Color: White.

End

SECTION 220700

PLUMBING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A Section Includes:

B Insulation Materials:

1. Cellular glass.
2. Flexible elastomeric.
3. Mineral fiber.
4. Polyolefin.
5. Polystyrene.

C Insulating cements.

1. Adhesives.
2. Mastics.
3. Sealants.
4. Factory-applied jackets.
5. Field-applied fabric-reinforcing mesh.
6. Field-applied jackets.
7. Tapes.

D Securements.

1. Corner angles.

E Related Sections include the following:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 23 Section "HVAC Insulation."

1.02 SUBMITTALS

A Product Data: For each type of product indicated.

B LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
2. Shop Drawings:
   a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   b. Detail attachment and covering of heat tracing inside insulation.
   c. Detail insulation application at pipe expansion joints for each type of insulation.
   d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   e. Detail removable insulation at piping specialties, equipment connections, and access panels.
   f. Detail application of field-applied jackets.
   g. Detail application at linkages of control devices.
   h. Detail field application for each equipment type.
   i. Field quality-control reports.

1.03 QUALITY ASSURANCE

A Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting 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 and inspecting agency.

B Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-

developed index of 50 or less.

C Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A Comply with requirements in Part 3 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 Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Cell-U-Foam Corporation; Ultra-CUF.
2. Pittsburgh Corning Corporation; Foamglas Super K.
3. Block Insulation: ASTM C 552, Type I.
4. Special-Shaped Insulation: ASTM C 552, Type III.
5. Board Insulation: ASTM C 552, Type IV.
6. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
7. Preformed Pipe Insulation with Factory-Applied ASJ ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
9. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

H Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Aeroflex USA Inc.; Aerocel.
2. Armacell LLC; AP Armaflex.
3. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
4. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

I Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Johns Manville; HTB 23 Spin-Glas.
2. Owens Corning; High Temperature Flexible Batt Insulations.
3. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

J Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Fibrex Insulations Inc.; FBX.

2. Johns Manville; 1000 Series Spin-Glas.
3. Owens Corning; High Temperature Industrial Board Insulations.
4. Rock Wool Manufacturing Company; Delta Board.
5. Roxul Inc.; Roxul RW.
6. Thermafiber; Thermafiber Industrial Felt.
7. Mineral-Fiber, Preformed Pipe Insulation:

K Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Fibrex Insulations Inc.; Coreplus 1200.
2. Johns Manville; Micro-Lok.
3. Knauf Insulation; 1000 Pipe Insulation.
4. Manson Insulation Inc.; Alley-K.
5. Owens Corning; Fiberglas Pipe Insulation.

L Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket with factory-applied ASJ with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

M Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

N Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corp.; CrimpWrap.
2. Johns Manville; MicroFlex.
3. Knauf Insulation; Pipe and Tank Insulation.
4. Manson Insulation Inc.; AK Flex.
5. Owens Corning; Fiberglas Pipe and Tank Insulation.
6. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

O Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Armacell LLC; Tubolit.
2. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
3. RBX Corporation; Therma-cell.
4. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

P Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Dow Chemical Company (The); Styrofoam.
2. Knauf Insulation; Knauf Polystyrene.

2.02 INSULATING CEMENTS

A Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Insulco, Division of MFS, Inc.; SmoothKote.
2. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
3. Rock Wool Manufacturing Company; Delta One Shot.

2.03 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 Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

C Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Childers Products, Division of ITW; CP-96.
2. Foster Products Corporation, H. B. Fuller Company; 81-33.
3. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Aeroflex USA Inc.; Aeroseal.
2. Armacell LCC; 520 Adhesive.
3. Foster Products Corporation, H. B. Fuller Company; 85-75.
4. RBX Corporation; Rubatex Contact Adhesive.
5. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Childers Products, Division of ITW; CP-82.
2. Foster Products Corporation, H. B. Fuller Company; 85-20.
3. ITW TACC, Division of Illinois Tool Works; S-90/80.
4. Marathon Industries, Inc.; 225.
5. Mon-Eco Industries, Inc.; 22-25.
6. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.

F Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Childers Products, Division of ITW; CP-96.
2. Foster Products Corporation, H. B. Fuller Company; 97-13.
3. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

G Products: Subject to compliance with requirements, provide the following provide

one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-82.
2. Foster Products Corporation, H. B. Fuller Company; 85-20.
3. ITW TACC, Division of Illinois Tool Works; S-90/80.
4. Marathon Industries, Inc.; 225.
5. Mon-Eco Industries, Inc.; 22-25.
6. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. PVC Jacket Adhesive: Compatible with PVC jacket.

H Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Dow Chemical Company (The); 739, Dow Silicone.
2. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
3. P.I.C. Plastics, Inc.; Welding Adhesive.
4. Speedline Corporation; Speedline Vinyl Adhesive.
5. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 MASTICS

A Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B For indoor applications, use mastics that have a VOC content of g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

D Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-35.
2. Foster Products Corporation, H. B. Fuller Company; 30-90.
3. ITW TACC, Division of Illinois Tool Works; CB-50.
4. Marathon Industries, Inc.; 590.
5. Mon-Eco Industries, Inc.; 55-40.
6. Vimasco Corporation; 749.
7. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
8. Service Temperature Range: Minus 20 to plus 180 deg F.
9. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
10. Color: White.
11. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

E Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-10.
2. Foster Products Corporation, H. B. Fuller Company; 35-00.
3. ITW TACC, Division of Illinois Tool Works; CB-05/15.
4. Marathon Industries, Inc.; 550.
5. Mon-Eco Industries, Inc.; 55-50.
6. Vimasco Corporation; WC-1/WC-5.

7. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
8. Service Temperature Range: Minus 20 to plus 200 deg F.
9. Solids Content: 63 percent by volume and 73 percent by weight.
10. Color: White.

2.05 SEALANTS

A Joint Sealants:

B Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-76.
2. Foster Products Corporation, H. B. Fuller Company; 30-45.
3. Marathon Industries, Inc.; 405.
4. Mon-Eco Industries, Inc.; 44-05.
5. Pittsburgh Corning Corporation; Pittseal 444.
6. Vimasco Corporation; 750.

C Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-70.
2. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
3. Marathon Industries, Inc.; 405.
4. Mon-Eco Industries, Inc.; 44-05.
5. Vimasco Corporation; 750.
6. Materials shall be compatible with insulation materials, jackets, and substrates.
7. Permanently flexible, elastomeric sealant.
8. Service Temperature Range: Minus 100 to plus 300 deg F.
9. Color: White or gray.
10. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. FSK and Metal Jacket Flashing Sealants:

D Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Childers Products, Division of ITW; CP-76-8.
2. Foster Products Corporation, H. B. Fuller Company; 95-44.
3. Marathon Industries, Inc.; 405.
4. Mon-Eco Industries, Inc.; 44-05.
5. Vimasco Corporation; 750.
6. Materials shall be compatible with insulation materials, jackets, and substrates.
7. Fire- and water-resistant, flexible, elastomeric sealant.
8. Service Temperature Range: Minus 40 to plus 250 deg F.
9. Color: Aluminum.
10. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

E Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work

include, but are not limited to, the following:

1. Childers Products, Division of ITW; 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.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.06 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. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

B Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
2. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

C Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
2. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

D Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.07 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. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for equipment and pipe.

1. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
2. Vimasco Corporation; Elastafab 894.

2.08 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.

C Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Johns Manville; Zeston.
2. P.I.C. Plastics, Inc.; FG Series.
3. Proto PVC Corporation; LoSmoke.
4. Speedline Corporation; SmokeSafe.

D Adhesive: As recommended by jacket material manufacturer.

E Color: White Color-code jackets based on system. Color as selected by Architect.

F Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

G 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.

H Factory-fabricated tank heads and tank side panels.

I Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

J Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Childers Products, Division of ITW; Metal Jacketing Systems.
2. PABCO Metals Corporation; Surefit.
3. RPR Products, Inc.; Insul-Mate.

K Sheet and roll stock ready for shop or field sizing Factory cut and rolled to size.

L Finish and thickness are indicated in field-applied jacket schedules.

M Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper 2.5-mil- (0.063-mm-) thick Polysurlyn.

N Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper 2.5-mil- (0.063-mm-) thick Polysurlyn.

O Factory-Fabricated Fitting Covers:
1. Same material, finish, and thickness as jacket.
2. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3. Tee covers.
4. Flange and union covers.
5. End caps.
6. Beveled collars.
7. Valve covers.
8. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

P 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.

Q Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Pittsburgh Corning Corporation; Pittwrap.
2. Polyguard; Insulrap No Torch 125.

2.09 TAPES

A ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
2. Compac Corp.; 104 and 105.
3. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
4. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   a. Width: 3 inches (75 mm).
   b. Thickness: 11.5 mils (0.29 mm).
   c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   d. Elongation: 2 percent.
   e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
5. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
6. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

C Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
2. Compac Corp.; 110 and 111.
3. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
4. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
   a. Width: 3 inches (75 mm).
   b. Thickness: 6.5 mils (0.16 mm).
   c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   d. Elongation: 2 percent.
   e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
5. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
6. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
7. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.
   e. Width: 2 inches (50 mm).
   f. Thickness: 6 mils (0.15 mm).
   g. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
   h. Elongation: 500 percent.
   i. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
8. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
9. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.

d. Venture Tape; 3520 CW.
e. Width: 2 inches (50 mm).
f. Thickness: 3.7 mils (0.093 mm).
g. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
h. Elongation: 5 percent.
i. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

10. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
11. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
    b. Width: 3 inches (75 mm).
    c. Film Thickness: 4 mils (0.10 mm) 6 mils (0.15 mm).
    d. Adhesive Thickness: 1.5 mils (0.04 mm).
    e. Elongation at Break: 145 percent.
    f. Tensile Strength: 55 lbf/inch (10.1 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 or closed seal.

B Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. Childers Products; Bands.
2. PABCO Metals Corporation; Bands.
3. RPR Products, Inc.; Bands.

C Insulation Pins and Hangers:

D 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:

E Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
1. AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2. GEMCO; Perforated Base.
3. Midwest Fasteners, Inc.; Spindle.

F Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

G Spindle: Copper- or zinc-coated, low carbon steel Aluminum Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

H Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

I 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:

J Products: Subject to compliance with requirements, provide the following provide one of the following 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.
3. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2

inches (38 mm) in diameter.

4. 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).
5. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
6. 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:

K Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2. GEMCO; Press and Peel.
3. Midwest Fasteners, Inc.; Self Stick.
4. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

L Spindle: Copper- or zinc-coated, low carbon steel Aluminum Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

M Adhesive-backed base with a peel-off protective cover.

N Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel aluminum 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.

O Products: Subject to compliance with requirements, provide the following provide one of the following 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.

P Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

Q 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.

R Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. GEMCO.
2. Midwest Fasteners, Inc.

S Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

T Wire: 0.080-inch (2.0-mm) nickel-copper alloy 0.062-inch (1.6-mm) soft-annealed, stainless steel 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

U 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:

1. C & F Wire.
2. Childers Products.
3. PABCO Metals Corporation.
4. RPR Products, Inc.

2.11 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

3.01 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.

3.02 GENERAL INSTALLATION REQUIREMENTS

A Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and 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.

K Install insulation continuously through hangers and around anchor attachments.

L 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.

M 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.

N 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.

O Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

P 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) 4 inches (100 mm) o.c.
4. For below ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

Q Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

R Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

S Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

T Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

U 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. Manholes.
5. Handholes.
6. Cleanouts.

3.03 PENETRATIONS

A Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

B Seal penetrations with flashing sealant.

C 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.

D Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

E Seal jacket to roof flashing with flashing sealant.

F Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

G Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

H Seal penetrations with flashing sealant.

I 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.

J Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

K Seal jacket to wall flashing with flashing sealant.

L Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

M Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

N Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

O Insulation Installation at Floor Penetrations:

P Pipe: Install insulation continuously through floor penetrations.

Q Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.04 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

B Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.

C Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.

D Protect exposed corners with secured corner angles.

E Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

1. Do not weld anchor pins to ASME-labeled pressure vessels.
2. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
3. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
4. Do not overcompress insulation during installation.
5. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
6. Impale insulation over anchor pins and attach speed washers.
7. 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.

F Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.

G Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.

H Stagger joints between insulation layers at least 3 inches (75 mm).

I Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

J Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

K For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

L Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

M Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

N Seal longitudinal seams and end joints.

3.05 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:

C Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

D 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.

E 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.

F 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.

G 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.

H 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.

I 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.

J For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

K Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

L Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.

M 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.

3.06 CELLULAR-GLASS INSULATION INSTALLATION

A Insulation Installation on Straight Pipes and Tubes:

B Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

C Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

D For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

E For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

F 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 cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

G Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

H Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. 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.

3.07 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

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.

3.08 MINERAL-FIBER INSULATION INSTALLATION

A Insulation Installation on Straight Pipes and Tubes:

B Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

C Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

D For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

E For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

F 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.

G 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.

H 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.

3.09 POLYOLEFIN INSULATION INSTALLATION

A Insulation Installation on Straight Pipes and Tubes:

B Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C 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 polyolefin 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.

D Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin 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.

E Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. 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.

3.10 POLYSTYRENE INSULATION INSTALLATION

A Insulation Installation on Straight Pipes and Tubes:

B Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.

C For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.

D All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

E 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, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

F Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Insulation Installation on Valves and Pipe Specialties:
3. Install preformed section of polystyrene insulation to valve body.
4. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
5. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

A Where FSK jackets are indicated, install as follows:

B Draw jacket material smooth and tight.

C Install lap or joint strips with same material as jacket.

D Secure jacket to insulation with manufacturer's recommended adhesive.

E Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.

F Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

G 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.

H Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

I 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.

J Where PVDC jackets are indicated, install as follows:

K Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.

L Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

M Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.

N Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

O Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.12 FINISHES

A Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

B 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.
C Finish Coat Material: Interior, flat, latex-emulsion size.
D Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
E Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
F Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL
A Perform tests and inspections.
B Tests and Inspections:
1. Inspect field-insulated equipment, 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 type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. 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 Insert number locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
3. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 DOMESTIC WATER BOILER BREECHING INSULATION SCHEDULE
A Round, Exposed Breeching and Connector Insulation: High-temperature mineral-fiber blanket board, 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
B Round, Concealed Breeching and Connector Insulation: High-temperature mineral-fiber blanket board, 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

3.15 EQUIPMENT INSULATION SCHEDULE
A Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
B Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
C Heat-Exchanger (Water-to-Water for Domestic Water Heating Service) Insulation: Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
D Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.
E Domestic Hot-Water Storage Tank Insulation: Mineral-Fiber Pipe and Tank: Of thickness to provide an R-value of 12.5.
F Piping System Filter-Housing Insulation: Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

3.16 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.

3.17 INDOOR PIPING INSULATION SCHEDULE

A Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:
1. Flexible Elastomeric: 3/4 inch (19 mm) 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) 1 inch (25 mm) thick.
3. Polyolefin: 3/4 inch (19 mm) 1 inch (25 mm) thick.

B Domestic Chilled Water (Potable): Insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

C Stormwater and Overflow: Insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

D Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

E 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: 1/2 inch (13 mm) 3/4 inch (19 mm) 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) 1 inch (25 mm) thick.
3. Polyolefin: 1/2 inch (13 mm) 3/4 inch (19 mm) 1 inch (25 mm) thick.

F Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be one of the following:
1. Cellular Glass: 2 inches (50 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches (38 mm) thick.

3.18 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A Retain "one of" option in subparagraphs in this article to allow Contractor to select piping materials from those retained.

B Domestic Water Piping: Insulation shall be one of the following:
1. Cellular Glass: 2 inches (50 mm) thick.
2. Flexible Elastomeric: 2 inches (50 mm) thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
4. Polyolefin: 2 inches (50 mm) thick.
5. Polystyrene: 2 inches (50 mm) thick.

C Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:
1. Cellular Glass: 2 inches (50 mm) thick.

2. Flexible Elastomeric: 2 inches (50 mm) thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
4. Polyolefin: 2 inches (50 mm) thick.

D Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be one of the following:
1. Cellular Glass: 2 inches (50 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.

3.19 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.

B Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) thick.

3.20 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.

1. Equipment, Concealed:
   a. PVC: 20 mils (0.5 mm) thick.
      1) Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
   b. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
      1) None.
      2) PVC: 20 mils (0.5 mm) thick.
      3) Aluminum, Smooth: 0.020 inch (0.51 mm) 0.024 inch (0.61 mm) 0.032 inch (0.81 mm) 0.040 inch (1.0 mm) thick.
2. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
   a. None.
   b. Painted Aluminum, Smooth with 2-1/2-Inch- (65-mm-) Deep Corrugations: thick.
3. Piping, Concealed:
   a. None.
   b. PVC: 20 mils (0.5 mm) thick.
   c. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.
   d. Insert jacket type.
4. Piping, Exposed:
   a. None.
   b. PVC PVC: 20 mils (0.5 mm) thick.
   c. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

3.21 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 Equipment, Concealed:
1. None.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

D Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
1. Painted Aluminum, Smooth Corrugated Stucco Embossed with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

E Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
1. Painted Aluminum, Smooth with 1-1/4-Inch- (32-mm-) Deep Corrugations: thick.

F Piping, Concealed:
1. None.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

G Piping, Exposed:
1. PVC: 20 mils (0.5 mm) thick.
2. Painted Aluminum, with Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

3.22 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

End

SECTION 221116

DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.
6. Escutcheons.
7. Sleeves and sleeve seals.

1.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7 or as directed by local codes.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 PRODUCTS

2.01 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.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. 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.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. 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. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.

a. Gaskets: AWWA C111, rubber.

2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.

a. Gaskets: AWWA C111, rubber.

2.04 CPVC PIPING AND FITTING SYSTEM

A. CPVC Tubing System for Pipe Sizes ½” Through 2”:

1. Product Description: FlowGuard Gold® CPVC pipe and fittings shall be extruded/molded from CPVC compounds manufactured by Lubrizol. The pipe compound shall meet cell class 24448 and the fitting compound shall meet cell class 23447 as defined by ASTM D1784. Both the pipe and the fitting compounds shall be certified by NSF International for use with potable water.

2. Pipe and Fittings: Pipe and fittings shall meet or exceed the requirements of ASTM D2846.

3. Solvent Cement: All socket type joints shall be assembled employing solvent cements that meet or exceed the requirements of ASTM F493. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be listed by NSF International for use with potable water, and approved by the FlowGuard Gold® pipe and fittings manufacturers.

4. Limitations: FlowGuard Gold® pipe and fittings are intended for use at a maximum working pressure of 100 psi at 180°F (400 psi at 73°F).

B. CPVC Tubing System for Pipe Sizes 2-1/2" and Larger:

1. Product Description: Corzan® CPVC pipe and fittings are extruded/molded from CPVC compounds manufactured by Lubrizol Advanced Materials. The pipe compounds shall meet cell class 24448 for high impact/high heat distortion temperature pipe (available through 6" and up to 8" from select manufacturers) or 23447 for pipe 8" or greater as defined by ASTM D1784. The pipe shall be certified by NSF International for use with potable water. Corzan CPVC fittings compound shall meet cell class 23447 and carry a pressure rating listed by PPI (Plastics Pipe Institute). This Corzan CPVC compound shall be pressure rated in accordance with ASTM D-2387 and PPI TR-3 and have hydrostatic design bases of 4000 psi at 72°F and 1000 psi at 180°F as listed in PPI publication TR-4.

2. Pipe and Fittings:

a. Pipe shall meet or exceed the requirements of ASTM F441 in Schedule 80.

b. Fittings shall meet or exceed the requirements of ASTM F437 (schedule 80 threaded), and ASTM F439 (schedule 80 socket).

3. Solvent Cement: All socket type joints shall be assembled employing solvent cements that meet or exceed the requirements of ASTM F493 and primers that meet or exceed the requirements of ASTM F656. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement and primer shall be listed by NSF International for use with potable water, and approved by the Corzan® pipe and fittings manufacturers.

4. Limitations: Pressure ratings for Corzan pipe and fittings vary depending on the pipe size and the water temperature. Consult the manufacturer's design and installation guide for more information.

2.05 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
2. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.06 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

1. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

2.07 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; 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. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

E. Solvent Cements for Joining CPVC Piping and Tubing

1. See Section 2.04 above for CPVC Solvent Cement requirements.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.08 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

C. Plastic-to-Metal Transition Fittings:

1. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.

D. Plastic-to-Metal Transition Unions:

1. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.09 FLEXIBLE CONNECTORS

A. 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 (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. 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 (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.10 WATER METERS

A. Compound-Type Water Meters:

1. Description:

a. Standard: AWWA C702.
b. Pressure Rating: 150-psig (1035-kPa) working pressure.
c. Body Design: With integral mainline and bypass meters; totalization meter.
d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
e. Case: Bronze.
f. Pipe Connections: Flanged.

PART 3 EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 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. CPVC Piping Systems: Installation practices such as pipe support spacing, bracing, allowance for thermal expansion/contraction, solvent cementing and handling and storage shall be in accordance with the manufacturer's instructions and this specification.

C. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gauges for Plumbing Piping" for pressure gauges and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. 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.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping adjacent to equipment and specialties to allow service and maintenance.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than 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 pressure gauges on suction and discharge piping from each plumbing pump and packaged booster pump.

S. Install thermostats in hot-water circulation piping.

T. Install thermometers on outlet piping from each water heater.

3.03 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: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: 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. 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.

G. Plastic 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. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

H. PEX Piping Joints: Join according to ASTM F 1807.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.05 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.06 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.07 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation, and install water meters according to utility company's requirements. Contact utility company directly to determine their requirements.

B. Install water meters according to AWWA M6, utility company's requirements, and the following:

C. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

D. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

E. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.08 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

E. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.09 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. 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.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. 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:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. 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.
3. 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.
4. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable and 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 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 (50 mg/L) 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 (200 mg/L) 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

A. See schedule on drawings for applications of pipe, tube, and fitting materials for specific services, service locations, and pipe sizes. If no schedule is provided on the drawings, the requirements listed below in this section apply.

B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

C. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

D. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6 (DN 100 to DN 150), shall be one of the following:

1. Push-on-joint, ductile-iron pipe; standard- or compact- pattern push-on-joint fittings; and gasketed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

F. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be one of 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 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.

G. Aboveground domestic water piping, shall be one of the following as selected by owner:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and soldered joints.
2. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.

3.14 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 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop 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.

D. CPVC and PVC valves matching piping materials may be used.

END

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Water pressure-reducing valves.
   4. Balancing valves.
   5. Temperature-actuated water mixing valves.
   6. Strainers.
   7. Hose bibbs.
   8. Wall hydrants.
   9. Drain valves.
   10. Water hammer arresters.
   11. Trap-seal primer valves.

B. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. NSF Compliance:
   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   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. Ames Co.
      b. Cash Acme.
      c. Conbraco Industries, Inc.
      d. FEBCO; SPX Valves & Controls.
      e. Rain Bird Corporation.
      f. Toro Company (The); Irrigation Div.
      g. Watts Industries, Inc.; Water Products Div.
      h. Zurn Plumbing Products Group; Wilkins Div.
   2. Standard: ASSE 1001.
   3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match

connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze Chrome plated.

B Hose-Connection Vacuum Breakers:
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. Arrowhead Brass Products, Inc.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Legend Valve.
   e. MIFAB, Inc.
   f. Prier Products, Inc.
   g. Watts Industries, Inc.; Water Products Div.
   h. Woodford Manufacturing Company.
   i. Zurn Plumbing Products Group; Light Commercial Operation.
   j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.02 BACKFLOW PREVENTERS

A Intermediate Atmospheric-Vent 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:
   a. Cash Acme.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Honeywell Water Controls.
   e. Legend Valve.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2 (DN 15) NPS 3/4 (DN 20).
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Rough bronze.

B Reduced-Pressure-Principle 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:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 10 psig (83 kPa) maximum, through middle 1/3 of flow range.

5. Size: See drawings.
6. Body: Bronze for NPS 2 (DN 50) and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved stainless steel for NPS 2-1/2 (DN 65) and larger.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C 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:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved stainless steel for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D 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:
   a. Conbraco Industries, Inc.
   b. FEBCO; SPX Valves & Controls.
   c. Flomatic Corporation.
   d. Watts Industries, Inc.; Water Products Div.
   e. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.03 WATER PRESSURE-REDUCING VALVES

A Water Regulators:
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. Cash Acme.
b. Conbraco Industries, Inc.
c. Honeywell Water Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Size: See drawings
5. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
6. Valves for Booster Heater Water Supply: Include integral bypass.
7. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.04 BALANCING VALVES

A Memory-Stop Balancing 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:
   a. Conbraco Industries, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.05 TEMPERATURE-ACTUATED WATER MIXING VALVES

A Water-Temperature Limiting Devices:

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. Armstrong International, Inc.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Honeywell Water Controls.
   e. Legend Valve.
   f. Leonard Valve Company.
   g. Powers; a Watts Industries Co.
   h. Symmons Industries, Inc.
   i. Taco, Inc.
   j. Watts Industries, Inc.; Water Products Div.
   k. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).

4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: See drawings
9. Tempered-Water Design Flow Rate: See drawings
10. Valve Finish: Chrome plated Rough bronze.

B Primary, Thermostatic, Water Mixing 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:
   a. Armstrong International, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. Powers; a Watts Industries Co.
   e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
9. Tempered-Water Setting: See drawings
10. Valve Finish: Rough bronze.

2.06 STRAINERS FOR DOMESTIC WATER PIPING

A Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 (DN 50) and Smaller: 0.062 inch (1.57 mm).
   b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.125 inch (3.18 mm).
   c. Strainers NPS 5 (DN 125) and Larger: 0.25 inch (6.35 mm).
6. Drain: Pipe plug Factory-installed, hose-end drain valve.

2.07 HOSE BIBBS

A Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).

7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle Operating key.
13. Operation for Finished Rooms: Wheel handle Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.08 WALL HYDRANTS

A Comply with requirements in "Piping Specialty Schedule" located on drawings for wall hydrants.

B Non-freeze Wall Hydrants:

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. Josam Company.
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Woodford Manufacturing Company.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

C Moderate-Climate Wall Hydrants:

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. Josam Company.
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Woodford Manufacturing Company.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage

Operation.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Polished nickel bronze Chrome plated Insert finish.
9. Outlet: Exposed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

D Vacuum Breaker Wall Hydrants:

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. Arrowhead Brass Products, Inc.
   b. Mansfield Plumbing Products LLC.
   c. McDonald, A. Y. Mfg. Co.
   d. Prier Products, Inc.
   e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Woodford Manufacturing Company.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig (860 kPa).
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4 (DN 15 or DN 20).
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.09 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 (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
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.

2.10 WATER HAMMER ARRESTERS

A Water Hammer Arresters:
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. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. PPP 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 Inc.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A Supply-Type, Trap-Seal Primer 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:
   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.01 INSTALLATION

A Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B 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 not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges 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 thermometers and water regulators if specified.
2. 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,.

G Install water hammer arresters in water piping according to PDI-WH 201.

H 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.

I Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

J Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Intermediate atmospheric-vent backflow preventers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.
4. Water pressure-reducing valves.
5. Primary, thermostatic, water mixing valves.
6. Supply-type, trap-seal primer valves.

K 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.02 FIELD QUALITY CONTROL

A Perform the following tests and prepare test reports:
1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.03 ADJUSTING

A Set field-adjustable pressure set points of water pressure-reducing valves.

B Set field-adjustable flow of balancing valves.

C Set field-adjustable temperature set points of temperature-actuated water mixing valves.

End

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.02 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).

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 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-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.

1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
c. Acceptable coupling manufacturers are Clamp-All, Husky, Mission, or approved equals.

C. Acceptable cast iron manufacturers are AB&I Foundry, Charlotte Pipe & Foundry, and Tyler Pipe. No others will be accepted.

D. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:

a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. See drawing plans and/or schedules for the locations in which each pipe material is to be used. Note that not all piping materials may be used on the project.

3.02 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."

E. 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."

F. 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 2 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.

G. 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.

H. 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 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) 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.

I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

A. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.04 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Use gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Use gate valve for piping NPS 2-1/2 (DN 65) and larger.

C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage 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. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.05 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

I. Install supports for vertical PVC piping every 48 inches (1200 mm).

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. 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. 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 (DN 65) and larger.

3.07 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. Re-inspection: 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.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

2. Prepare reports for tests and required corrective action.

3.08 CLEANING

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.

3.09 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. Grease interceptors.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.03 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater 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 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.
4. Standard: ASME A112.14.1.
5. Size: Same as connected piping.
6. Body: Cast iron.
7. Cover: Cast iron with bolted or threaded access check valve.
8. End Connections: Hub and spigot or hubless.
9. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
10. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater 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. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Size: Same as floor drain outlet.
4. Body: 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.

2.02 CLEANOUTS

A Exposed Cast-Iron Cleanouts:
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. 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.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B Cast-Iron Floor Cleanouts:
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. 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.
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Cast-iron plug.
9. Adjustable Housing Material: Cast iron with threads set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze,.

11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C Cast-Iron Wall Cleanouts:

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. 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.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass 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 wall-installation frame and cover.

2.03 FLOOR DRAINS

A Cast-Iron Floor Drains:

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. 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. Standard: ASME A112.6.3.
3. Pattern: See drawings
4. Body Material: Cast iron.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Sediment Bucket: For area drains and floor sinks only.
9. Top or Strainer Material: Bronze.
10. Top of Body and Strainer Finish: Polished bronze.
11. Top Shape: See drawings.
12. Top Loading Classification: Heavy Duty.
13. Funnel: As required for kitchen.
14. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

15. Trap Material: Cast iron.
16. Trap Pattern: Standard P-trap.
17. Trap Features: Trap-seal primer valve drain connection.

2.04 ROOF FLASHING ASSEMBLIES

A Roof Flashing 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:
   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.

B Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.05 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.

B Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C 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.

D 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.

E 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 (25 mm) 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.

F 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.

G 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.

2.06 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. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B Fasteners: Metal compatible with material and substrate being fastened.

C Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D Solder: ASTM B 32, lead-free alloy.

E Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.07 GREASE INTERCEPTORS

A Grease Interceptors:

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. Applied Chemical Technology, Incorporated.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Rockford Sanitary Systems, Inc.
   e. Schier Products Company.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zurn Plumbing Products Group; Light Commercial Operation.
   j. Zurn Plumbing Products Group; Specification Drainage Operation.
   k. Ashland Trap Distribution Co.
   l. Bio-Microbics, Inc.
   m. Canplas LLC.
   n. Schier Products Company.
   o. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or processing wastewater.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Cast iron or steel.
5. Interior Lining: Not required.
6. Exterior Coating: Corrosion-resistant enamel.
7. Grease Retention Capacity: 1,500 gallons.
8. Inlet and Outlet Size: 4”
9. End Connections: Flanged.
10. Cleanout: Integral.
11. Mounting: Recessed, flush with floor.
12. Flow-Control Fitting: Required.
13. Operation: Semiautomatic, manual drawoff.

PART 3 - EXECUTION

3.01 INSTALLATION

A Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B 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.

C 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 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

D For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F 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 (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) 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.

G Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.

J Install deep-seal traps on floor drains and other waste outlets, if indicated.

K 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.

L Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N Install vent caps on each vent pipe passing through roof.

O Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with

cover flush with finished floor.

3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

A Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B Install piping adjacent to equipment to allow service and maintenance.

C Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.03 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. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

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 (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) 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 Division 07 Section "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.

3.04 LABELING AND IDENTIFYING

A Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.05 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 221616

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.02 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: See drawings.

C. 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.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. 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.

C. Welding certificates.

D. Field quality-control reports.

E. Operation and maintenance data.

1.04 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

2.01 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 (34.5 kPa).

2.02 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 (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm).

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.

2.03 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.

2.04 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 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. 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.

F. 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 (125 mm) 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.

2.05 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:

    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.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.06 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:

    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.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

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:

   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.07 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. McDonald, A. Y. Mfg. Co.
5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
6. Wilkins; Zurn Plumbing Products Group.
7.

B. Minimum Operating-Pressure Rating: 150 psig.

C. Combination fitting of copper alloy and ferrous materials.

D. Insulating materials suitable for natural gas.

E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.08 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.09 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 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

3.01 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

D. Install fittings for changes in direction and branch connections.

E. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron 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.

F. 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.

G. Install pressure gauge downstream or upstream and downstream from each service regulator. Pressure gauges are specified in Division 15 Section "Meters and Gauges."

3.02 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code 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. 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 in Division 7 Section "Through-Penetration Firestop Systems."

L. Verify final equipment locations for roughing-in.

M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

N. 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.

O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. 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.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Division 15 Section "Meters and Gauges."

3.03 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.

3.04 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 burrs 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.

3.05 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 15 Section "Hangers and Supports."

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.

3.06 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.

3.07 LABELING AND IDENTIFYING

A. Comply with requirements in Division 15 Section "Mechanical Identification" 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.

3.08 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to the International Fuel Gas Code 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.

3.09 OUTDOOR PIPING SCHEDULE

A. Underground and aboveground natural-gas piping shall be as indicated on the drawings.

3.10 INDOOR PIPING SCHEDULE

A. Indoor natural gas piping shall be as indicated on the drawings.

3.11 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: Bronze plug valves.

3.12 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, full-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, full-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.

SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Faucets for lavatories, bathtubs, bathtub/showers, showers, and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Dishwasher air-gap fittings.
7. Disposers.
8. Hot-water dispensers.
9. Water closets.
10. Urinals.
11. Lavatories.
12. Bathtubs.
13. Individual showers.
14. Kitchen sinks.
15. Service sinks.
16. Laundry trays.

1.02 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. FRP: Fiberglass-reinforced plastic.

C. PMMA: Polymethyl methacrylate (acrylic) plastic.

D. PVC: Polyvinyl chloride plastic.

E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data to owner.

1.04 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"; Public Law 101-336, "Americans with Disabilities Act"; and with all local accessibility codes 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:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Laundry Trays: ANSI Z124.6.
3. Plastic Shower Enclosures: ANSI Z124.2.
4. Plastic Sinks: ANSI Z124.6.
5. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
6. Slip-Resistant Bathing Surfaces: ASTM F 462.
7. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
8. Stainless-Steel Residential Sinks: ASME A112.19.3.
9. Vitreous-China Fixtures: ASME A112.19.2M.
10. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
11. Water-Closet, Flushometer Tank Trim: ASSE 1037.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for bathtub, bathtub/shower, and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.

2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1.
4. Hand-Held Showers: ASSE 1014.
5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Manual-Control Anti-scald Faucets: ASTM F 444.
8. Pipe Threads: ASME B1.20.1.
9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Thermostatic-Control Anti-scald Faucets: ASTM F 444 and ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Grab Bars: ASTM F 446.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Hot-Water Dispensers: ASSE 1023 and UL 499.
7. Off-Floor Fixture Supports: ASME A112.6.1M.
8. Pipe Threads: ASME B1.20.1.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

1.01 FIXTURES - See drawing schedule for fixture product information.

1.02 FIXTURE SUPPLIES

A. Fixture supply valve kit shall include chrome plated brass stops with full turn brass stem, chrome plated copper risers where visible to the public or plastic risers where fixture is located in a private unit (dwelling, office, hotel room, etc.), and shallow steel or forged brass with set screw flange. Inlet shall be sized per the fixture schedule, IPS or sweat connection to valve inlet only, compression fittings will not be allowed at valve inlet. Outlet shall be sized to match the connected fixture inlet(s) with IPS or compression connections. Supply kit shall be by Brass Craft, McGuire, Watts or approved equal.

PART 3 - EXECUTION

1.01 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.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. 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 flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. 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.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. 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.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

S. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Connect inlet hose to dishwasher and outlet hose to disposer.

T. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

U. 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.

V. Set bathtubs and showers in leveling bed of cement grout.

W. 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."

1.02 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."

1.03 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.

E. Install fresh batteries in sensor-operated mechanisms.

1.04 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

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A The General Conditions, Supplementary General Conditions and/or Special Conditions in DIVISION 1 of these Specifications, apply to the work specified in all Sections of DIVISION 23.

1.02 DESCRIPTION

A These Mechanical General Provisions specified herein shall apply to all Sections of DIVISION 23.

1.03 NOTICE

A The use of asbestos materials or any other materials known to endanger the health and/or safety of the construction workers or future building occupants shall be prohibited in the construction of this project.

1.04 DISCREPANCIES

A The Contractor shall review the drawings and specifications and should he find discrepancies or omissions in the documents or be in doubt as the intent thereof, he shall immediately obtain clarification from the Architect prior to submitting his proposal for work in this DIVISION.

1.05 DEFINITIONS

A The following definitions or terms shall be applicable to this DIVISION:

1.06 PROVIDE: As used herein shall mean "furnish, install and connect complete".

A WORK: As used herein shall mean “the materials completely installed including all labor involved”.

(1) EXPOSED: As used herein shall mean all piping, ductwork, equipment and/or other components of the Mechanical Systems that can be seen when the building is complete without opening or removing access doors, panels or ceiling tiles.

(2) CONCEALED: As used herein shall mean all piping, ductwork, equipment and/or other components of the Mechanical Systems that cannot be seen when the building is complete, without opening or removing access doors, panels or ceiling tiles.

1.07 CODES AND STANDARDS

A Reference is to the latest edition of the code or standard, unless otherwise noted.

B The codes and standards referred to are minimum requirements. Where the requirements of these Specifications and the accompanying drawings exceed those of the codes and standards, the drawings and specifications shall be followed.

(1) All gas equipment shall bear the approval of the (American Gas Association) AGA.

(2) Reference to technical society, organization or body is made in the Specifications in accordance with the following abbreviations:

(a) AIA American Institute of Architects
(b) ACI American Concrete Institute
(c) AIEE American Institute of Electrical Engineers
(d) AISC American Institute of Steel Construction
(e) ANSI American National Standards Institute

(f)	ASME	American Society of Mechanical Engineers
(g)	ASTM	American Society of Testing Materials
(h)	AWSC	American Welding Society Code
(i)	FS	Federal Specifications
(j)	NFPA	National Fire Protection Association
(k)	NBS	National Bureau of Standards
(l)	NEC	National Electrical Code
(m)	SPR	Simplified Practice Recommendation
(n)	UL	Underwriters Laboratories, Inc.

1.08 PERMITS

A Obtain all permits required for the installation of this work and pay all fees in connection therewith.

B Provide three copies of inspection certificates from all authorities having jurisdiction, prior to request for final payment.

1.09 SHOP DRAWINGS/SUBMITTALS

A The contractor shall prepare, submit and obtain engineer's approval of manufacturer's shop drawings prior to the order, purchasing, or fabricating any mechanical equipment. Shop drawings shall include: all new equipment scheduled or specified on the drawings, and insulation and duct liner. Shop drawings shall have the equipment documents labeled to match the unit designation (TAG) shown on the drawings. Provide all information indicated on the schedules or on the drawings. If the contractor proposes any deviations in the equipment from what is indicated on the drawing he should note the deviations on the submittal. Submit all equipment at the same time.

1.10 QUALITY ASSURANCE

A Where several manufacturers are specified for a piece of equipment, apparatus, device, product or material, the Contractor shall provide the particular make and model number for any one of the manufacturers which meets the specifications. Where the make and model number of one manufacturer is named in the specifications, such reference shall be interpreted as establishing a standard of quality and the Contractor may at his option use an approved equal piece of equipment, apparatus, device, product or material of one of the other named manufacturers.

1.11 DRAWINGS

A Except where dimensions are shown, the drawings are diagrammatic and shall not be scaled. Exact location of fixtures, apparatus, ductwork and piping shall be determined by dimensions on the site.

1.12 JOB CONDITIONS

A The drawings indicate the locations of apparatus, fixtures, ductwork and piping and shall be followed as closely as possible. If before the installation it is found necessary to change the location to accommodate conditions at the building, such changes shall be made at no additional cost to the Owner and as approved by the Architect.

B Equipment requiring service or maintenance during the life of the system shall be made easily accessible.

C Piping, equipment or ductwork shall not be installed in electrical equipment rooms or elevator equipment rooms, unless specifically indicated on drawings. Piping, equipment or ductwork shall not be installed directly above, below or within 42" on all sides, of electrical equipment (switchboards, panelboards, motor

control centers, transformers and starters) from the floor to the structure above.

D Use of open-flame devices in work shall be accompanied by fire extinguishing apparatus within 25 feet of work location.

1.13 AS-BUILT DRAWINGS

A Maintain accurate records on a set of Contract Drawings of all deviations from the drawings made during the progress of the work to be used in preparation of the final as-built drawings. The completed set of drawings, with the nature and extent of all deviations clearly shown, shall be submitted to the Architect upon completion and acceptance of the work.

1.14 MATERIAL SUBSTITUTIONS

A Material substitution submittals shall include complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance, test data and evidence that the proposed manufacturer or his established representative maintains a qualified service organization including spare parts and is available for competent service on short notice.

B Each bidder by submitting his bid represents that any articles, devices, or products which varies from the type either specified or detailed shall be incorporated into the project without claims against the Owner for additional cost.

1.15 LAYOUT BASIS

A The layout is based upon the use of particular items of equipment, identified by manufacturers' make and model number. Dimensions, arrangements and service connections required for these particular items have been considered in making the layout. The Contractor may use the equipment of any manufacturer whose name is approved for substitution on that item of equipment after he has ascertained, in writing, that equipment properly fits within available space, required access space is provided and that all required service connections will be made at no additional cost to the Owner.

B Should shop drawings disclose that the above-mentioned requirements cannot be met with the proposed substitute equipment, then the Architect may require that the equipment as specified for "Layout Basis" be furnished.

1.16 MAINTENANCE DATA

A Submit three manuals in hardback three ring, loose leaf binders, covering details of operation and maintenance for all apparatus requiring service including:

(1) Title page with job name, Contractor's and Subcontractors' names, addresses and telephone numbers.

(2) Index Sheet

(3) Manufacturer's operating and maintenance manuals, including parts lists for each piece of equipment and accessory requiring service or maintenance, the guarantee period and the name, address and telephone number of the nearest sales and service organization for each item.

(4) Complete description of functions and operations of each piece of equipment including description of how equipment operates in conjunction with automatic control systems. Instructions for cleaning, oiling, greasing and similar maintenance procedures.

(5) Copies of inspection certificates provided by the City, County, State and insurance companies.

(6) Approved start and completion guarantee dates.

(7) All contents shall be typewritten.

(8) Provide a metal cabinet mounted on the wall of the Maintenance Room (or area approved by owner) to house the maintenance data manual. The cabinet shall be approximately 12" wide x 18" high x 6" deep constructed of 18 gauge sheet metal with hinged door with latch. Cabinet shall be painted black and shall be labeled with 1/4" letters "MAINTENANCE DATA".

1.17 GUARANTEE

A Each piece of apparatus shall be guaranteed to be of the customary standard and quality furnished by the designated manufacturer for that catalog number.

B All warranties specified for equipment shall also be provided.

1.18 WORKMANSHIP

A The Architect reserves the right to direct the removal of any item, which in his opinion does not present an orderly, neat and good workmanlike appearance, provided such items can be installed in an orderly manner by the usual methods. Such removal and replacement shall be done when written instructions are received from the Architect and shall be performed at the Contractor's expense without additional costs to the Owner.

B Poor workmanship shall be sufficient cause for rejection of this work.

End of Section

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 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.

1.02 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

2.01 GENERAL MOTOR REQUIREMENTS

A Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
B Comply with NEMA MG 1 unless otherwise indicated.

2.02 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.

2.03 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.
(3) Rotor: Random-wound, squirrel cage.
(4) Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
(5) Temperature Rise: Match insulation rating.
(6) Insulation: Class F
(7) Code Letter Designation:

E Starting codes in first subparagraph below are adequate for most variable-torque loads encountered in HVAC applications; 15 hp is a common breakpoint in rating among manufacturers when Code F and Code G apply. Retain both subparagraphs and options unless Project conditions or equipment characteristics dictate otherwise.

(1) Motors 15 HP and Larger: NEMA starting Code F or Code G.
(2) Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

F See "Product Characteristics" Article in the Evaluations for enclosure frame material discussion. Retain paragraph below to require other than manufacturer's standard enclosure materials. Specify other types of enclosures in motorized-equipment Sections.

(1) Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 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.

2.05 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.

(1) Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

(2) Motors 1/20 HP and Smaller: Shaded-pole type.

(3) Thermal Protection: Internal protection to automatically open ower 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

SECTION 230549 - MECHANICAL SOUND AND VIBRATION ISOLATION

PART 1 GENERAL

1.01 The mechanical sound, and vibration isolation equipment and products shall be sized and provided by one of the manufacturers listed below.

A. Kinetics Noise Control
B. Mason
C. Amber/Booth

1.02 The manufacturer and/or his representative shall select all vibration isolation products in accordance with requirements listed in the execution section of this specification. The manufacturer shall provide installation instructions for all provided isolators. Locations of vibration isolation products shall be coordinated with equipment details shown on the drawings and also as specified in these specifications for maximum support locations for piping and other equipment.

PART 2 PRODUCTS

2.01 All equipment shall be mounted or suspended from foundations and supports as specified herein or as detailed on the drawings.

2.02 The vibration isolation products and systems shall have a deflection as recommended by the manufacturer but not less than the deflection indicated in the ASHRAE Guidelines.

2.03 Where equipment such as air handling units are internally isolated, external isolation is not required.

2.04 All pad mounted equipment that requires isolation shall be isolated with 1” deflection spring isolators.

2.05 All suspended equipment and piping that require isolation shall be isolated with combination rubber and spring 1” deflection isolation.

PART 3 EXECUTION

3.01 If the equipment provided is not furnished with integral structural steel supports, mounting feet or lifting lugs, the contractor shall provide miscellaneous steel shapes as required to install or suspend the equipment and attach the vibration isolation as specified herein.

3.02 Support steel shall include but not be limited to rails, brackets, angles, channels, and similar components.

3.03 Provide flexible duct connection at the outlet and inlet of all fan coil units, fans, and air handlers.

3.04 All equipment specified to be isolated shall be installed and isolators shall be attached to the building structure or floor and the vibration isolators shall be adjusted and leveled so that the vibration isolators are performing properly.

3.05 All vibration isolation products shall be installed as outlined in the manufacturer’s printed installation instructions.

3.06 All isolation materials and flexible connectors shall be of the same manufacturer and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

3.07 All suspended mechanical equipment 0.75 HP and over listed in the equipment schedule shall be supported using vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure.

3.08 Install full line size flexible pipe connectors at the inlet and outlet of each pump and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipefitting schedule. Control rods, rubber bellows or protective braids must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.

3.09 Horizontal Pipe Isolation: all HVAC pumped water, pumped condensate, and refrigerant piping size 1-1/4" and larger within mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50' or 100 pipe diameters from rotating equipment.

3.10 All plumbing pumped water, pumped condensate piping size 1-1/4" and larger within mechanical rooms shall be isolated the same as HVAC piping. Isolators are not required for any plumbing pumped water, or pumped condensate, outside of mechanical rooms unless listed in the isolation schedule.

3.11 Isolate all duct work with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler.

3.12 Vibration Isolation Certificate of Compliance

A. The manufacturer's representative shall be responsible for providing such assistance and supervision as necessary to assure a correct installation and adjustment of vibration isolation products.
B. The manufacturer's representative shall visit the installation once all installed items have been completed but prior to the installation of ceilings or walls that may conceal any devices and inspect the installation for compliance with the manufacturer's installation instructions. Upon satisfaction that all devices are installed correctly, and systems are isolated properly, the representative shall submit a written report outlining the installation as in compliance with these specifications and also the manufacturer's installation instructions.

End of Section

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

(1) Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.

(2) Adjusting total HVAC systems to provide indicated quantities.

(3) Measuring electrical performance of HVAC equipment.

(4) Setting quantitative performance of HVAC equipment.

(5) Verifying that automatic control devices are functioning properly.

(6) Reporting results of the activities and procedures specified in this Section.

1.03 DEFINITIONS

A Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as reduce fan speed or adjust a damper.

B Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E Report Forms: Test data sheets for recording test data in logical order.

F Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

G Test: A procedure to determine quantitative performance of a system or equipment.

H Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

I AABC: Associated Air Balance Council.

J AMCA: Air Movement and Control Association.

K NEBB: National Environmental Balancing Bureau.

L SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.04 QUALITY ASSURANCE

A Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC.

B Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."

C Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.

D Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.05 PROJECT CONDITIONS

A Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.06 COORDINATION

A Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

1.07 WARRANTY

A General Warranty: The national project performance guarantee 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 National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION – AIR SYSTEMS

3.01 EXAMINATION

A Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

B Contract Documents are defined in the General and Supplementary Conditions of the Contract.

C Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

D Examine approved submittal data of HVAC systems and equipment.

E Examine Architect's and Engineer's 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.

F Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

G Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I Examine equipment for installation and for properly operating safety interlocks and controls.

J Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.02 PREPARATION

A Complete system readiness checks and prepare system readiness reports. Verify the following:

B Permanent electrical power wiring is complete.

C Automatic temperature-control systems are operational.

D Equipment and duct access doors are securely closed.

E Balance and fire dampers are open.

F Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

G Windows and doors can be closed so design conditions for system operations can be met.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

A Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.

B Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

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 Verify that motor starters are equipped with properly sized thermal protection.

E Check dampers for proper position to achieve desired airflow path.

F Check for airflow blockages.

G Check condensate drains for proper connections and functioning.

H Check for proper sealing of air-handling unit components.

3.05 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.

B Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

C Measure fan static pressures to determine actual static pressure as follows:

D Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.

E Measure static pressure directly at the fan outlet or through the flexible connection.

F Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

G Adjust fan speed higher or lower than design with the approval of the Architect.

Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

H 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 no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

I Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

J Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

K Where sufficient space in submains 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.

L Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

M Measure terminal outlets and inlets without making adjustments.

N Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

O Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

P Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.

Q Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 VARIABLE AIR VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to variable-volume supply-air systems.

B. Select the terminal unit that is most critical to the supply fan airflow. Measure inlet static pressure and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

C. Calibrate and balance each terminal unit for maximum and minimum design flow. Once maximum airflow is correct, balance air outlets downstream from terminal units.

D. Adjust fans to deliver maximum total design airflows within the maximum allowable rpm listed by the fan manufacturer.

E. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor air conditions; set terminal units to maximum airflow.

F. Where sufficient space in submains and branch duct is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for the zone.

G. Measure static pressure directly at the fan outlet or through the flexible connection.

H. Measure inlet static pressure at the fan inlet or through the flexible connection.

I. Set final return and outside airflow while operating at maximum return airflow and minimum outdoor airflow.

J. Adjust volume dampers for return main duct, submain ducts, and major return branch ducts to indicated airflows. Measure airflow and adjust submain branch duct volume dampers for specified airflow, and then re-measure each after all have been adjusted.

K. Measure air inlets airflow and adjust each inlet for specified airflow, and then re-measure after all have been adjusted.
L. Verify all terminal units are meeting design airflow under system maximum flow.
M. Re-measure inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure.

3.07 MOTORS

A Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
(1) Manufacturer, model, and serial numbers.
(2) Motor horsepower rating.
(3) Motor rpm.
(4) Efficiency rating if high-efficiency motor.
(5) Nameplate and measured voltage, each phase.
(6) Nameplate and measured amperage, each phase.
(7) Starter thermal-protection-element rating.

3.08 TEMPERATURE TESTING

A During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
B Measure indoor wet-bulb and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
C Measure outside-air, wet-bulb and dry-bulb temperatures.

3.09 TOLERANCES

A Set HVAC system airflow rates within the following tolerances:
(1) Supply, Return, and Exhaust Fans: Plus 10 or minus 5 percent.
(2) Supply Air Outlets: Plus or minus 5 percent.
(3) Return and Exhaust Air Inlets: Plus or minus 10 percent.

3.10 FINAL REPORT

A General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
B Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
C Include a list of the instruments used for procedures, along with proof of calibration.
D Final Report Contents: In addition to the 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, but do not include approved Shop Drawings and Product Data.
(5) General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
(a) Title page.
(b) Name and address of testing, adjusting, and balancing agent.
(c) Project name.
(d) Project location.

(e) Architect's name and address.
(f) Engineer's name and address.
(g) Contractor's name and address.
(h) Report date.
(i) Signature of testing, adjusting, and balancing Agent who certifies the report.
(j) Summary of contents, including the following:
(1) Design versus final performance.
(2) Notable characteristics of systems.
(3) Description of system operation sequence if it varies from the Contract Documents.
(4) Notes to explain why certain final data in the body of reports vary from design values.

E Instrument Calibration Reports: For instrument calibration, include the following:
(1) Report Data: Include the following:
(a) Instrument type and make.
(b) Serial number.
(c) Application.
(d) Dates of use.
(e) Dates of calibration.

3.11 ADDITIONAL TESTS

A Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

End of Section

SECTION 230700 - DUCT INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes semi-rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds. See “General Notes” for duct-liner and install where shown on drawings.

1.03 QUALITY ASSURANCE

A Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

C Insulation Installed Indoors: Flame-spread rating of 25 or less and smoke-developed rating of 50 or less.

1.04 SCHEDULING

A Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(1) Mineral-Fiber Insulation:
- (a) CertainTeed Manson.
- (b) Knauf FiberGlass GmbH.
- (c) Owens-Corning Fiberglas Corp.
- (d) Schuller International, Inc.

(2) Elastomeric Pipe Insulation:
- (a) Aeroflex USA Inc.; Aerocel
- (b) Armacell LLC; AP Armaflex
- (c) RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180

2.02 INSULATION MATERIALS

A Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

B ACCESSORIES AND ATTACHMENTS

(1) Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and

Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz. /sq. yd.
(a) Tape Width: 4 inches.
(2) Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
(a) Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
(b) Galvanized Steel: 0.005 inch thick.
(c) Aluminum: 0.007 inch thick.
(d) Brass: 0.010 inch thick.
(e) Nickel-Copper Alloy: 0.005 inch thick.
(f) Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
(g) Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
(h) Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.

C Flexible Elastomeric Refrigerant Pipe Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534 Type I for tubular materials..

2.03 VAPOR RETARDERS

A Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

3.01 PREPARATION

A Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 APPLICATION THICKNESS

A See schedule sheet for insulation schedule.

3.03 GENERAL APPLICATION REQUIREMENTS

A Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B Refer to schedules on the drawings for materials, forms, jackets, and thicknesses required for each duct system.

C Apply multiple layers of insulation with longitudinal and end seams staggered.

D Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

E Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

F Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

G Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

H Apply insulation with integral jackets as follows:

I Pull jacket tight and smooth.

J Joints and Seams: Cover with tape and vapor retarder as recommended by

insulation material manufacturer to maintain vapor seal.

K Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

M Seal penetrations with vapor-retarder mastic.

N Apply insulation for exterior applications tightly joined to interior insulation ends.

O Seal insulation to roof flashing with vapor-retarder mastic.

P Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.04 MINERAL-FIBER INSULATION APPLICATION

A Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

B Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.

C Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

D Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

E On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

F On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.

G Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

H Do not over compress insulation during installation.

I Impale insulation over anchors and attach speed washers.

J Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.

K Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round duct elbows with individually mitered gores cut to fit the elbow.

L Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.

M Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.05 DUCT SYSTEM APPLICATIONS

A Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

(1) Metal ducts with duct liner.

(2) Factory-insulated flexible ducts.

(3) Flexible connectors.

(4) Vibration-control devices.

(5) Testing agency labels and stamps.

(6) Nameplates and data plates.
(7) Access panels and doors in air-distribution systems.

3.06 REFRIGERANT PIPING APPLICATIONS

A Refrigerant Suction and Hot-Gas Piping or tubing:
(1) Indoor applications: Flexible Elastomeric, 1-inch thick.
(2) Indoor applications: Flexible Elastomeric, 2-inch thick.

End

SECTION 230923 – DIRECT-DIGITAL-CONTROL-SYSTEM (DDCS) FOR HVAC

PART 2 - PRODUCTS

1.01 SOFTWARE

1.01.1 OPERATOR INTERFACE

A. Description. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a standalone web server operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface. Operators with sufficient access level shall have an ability to make changes to all system and equipment graphics in the web server in addition to having full DDC system access to make configuration changes to the control system. Any tools required for making graphic changes shall be provided with web server.

B. Operator Interface. Furnish one Web server interface as shown on the system drawings. Operators shall be able to access all necessary operational information in the DDC system via client computer utilizing web browser.

(1) Web server shall connect via the LAN and be able to simultaneously serve up controller information to multiple operators connected via LAN with web browsers. Each client web browser connected to server shall be able to access all system information.

C. Web Server Hardware. Furnish one web server with Ethernet port for LAN or direct operator client computer access. The web server shall be capable of communicating to the peer to peer DDC controller network. Any required installation or commissioning software shall be pre-installed on the web server. Installation or commissioning of the web server shall be done through a client computer with a standard web browser.

D. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

E. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

(1) Log In and Log Out. System shall require user name and password to log in to operator interface.

(2) Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

(3) View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as set points, PID gains, on and off controls, and sensor calibration.

(4) View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

(5) View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear

(delete) unneeded alarms. Remote users shall be able to receive alarms via emails or cell phone text messages.

(6) View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

(7) View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

(8) Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

(9) Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

F. System Software.

(1) Operating System and required software. Web server operator interface shall be a self-contained web server without the need for any type of maintenance.

(2) System Graphics. Operator interface shall be graphical and shall include at least one graphic per piece of equipment or occupied zone, graphics for each RTU, and graphics that summarize conditions of building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

(a) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

(b) Animation. Graphics shall be able to animate by displaying different image files for changed object status.

(c) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

(d) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins.

G. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from the web browser interface.

(1) Automatic System Database Configuration. Each web server shall store internally store a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

(2) Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
(3) System Configuration. Operators shall be able to configure the system.
(4) Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.
(5) Security. System shall require a user name and password to view, edit, add, or delete data.
    (a) Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object.
    (b) Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.
    (c) Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.
(6) System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).
(7) Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Points List. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
(8) Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.
(9) Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.
(10) Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server from each workstation or web browser interface.
(11) Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Points List. Trends shall be BACnet trend objects.
(12) Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics.
(13) Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
    (a) Standard Reports. Furnish the following standard system reports:
        (1) Reports shall be filtered based upon the selected equipment
        (2) Alarm Reports

a) Alarm Summary - Current alarms
b) Alarm Sources – List of equipment and associated alarm conditions
c) Alarm Actions – Configured alarm actions such as e-mail and alarm pop-up

(3) Schedule Reports
a) Effective Schedules – Displays effective schedules for each equipment
b) Schedule Instances – Displays all schedules entered

(4) Security Reports – Maintains audit of all actions taken through user interface

(5) Commissioning Reports – Provide equipment checkout status and notes

(6) Equipment Reports – Provide reports showing trended points and available network points

(b) Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

(14) Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

H. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: Equal to drawing scale.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

B. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: STM B 88, Type K or L or ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
3. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
4. Operator: Rising stem and hand wheel.
5. Seat: Nylon.
6. End Connections: Socket, union, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Bonnet: Forged brass or cast bronze.
3. Packing: Molded stem, back seating, and replaceable under pressure.
4. Operator: Rising stem.
5. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
6. Seal Cap: Forged-brass or valox hex cap.
7. End Connections: Socket, union, threaded, or flanged.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
3. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
4. Piston: Removable polytetrafluoroethylene seat.
5. Closing Spring: Stainless steel.
6. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
7. End Connections: Socket, union, threaded, or flanged.
8. Maximum Opening Pressure: 0.50 psig.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body: Forged brass with brass cap including key end to remove core.
3. Core: Removable ball-type check valve with stainless-steel spring.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Copper spring.
6. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Bonnet: Plated steel.
3. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
7. Working Pressure Rating: 400 psig.
8. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
3. Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with AHRI 750.

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body, Bonnet, and Seal Cap: Forged brass or steel.
3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Packing and Gaskets: Non-asbestos.
5. Capillary and Bulb: Copper tubing filled with refrigerant charge.
6. Suction Temperature: 40 deg F.
7. Superheat: Nonadjustable.
8. Reverse-flow option (for heat-pump applications).
9. End Connections: Socket, flare, or threaded union.
10. Working Pressure Rating: 700 psig.

H. Straight-Type Strainers:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body: Welded steel with corrosion-resistant coating.
3. Screen: 100-mesh stainless steel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

I. Angle-Type Strainers:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body: Forged brass or cast bronze.
3. Drain Plug: Brass hex plug.
4. Screen: 100-mesh monel.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

J. Moisture/Liquid Indicators:

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body: Forged brass.
3. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
4. Indicator: Color coded to show moisture content in parts per million (ppm).
5. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
6. End Connections: Socket or flare.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

K. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
4. Desiccant Media: Activated [alumina] [charcoal].
5. Designed for reverse flow (for heat-pump applications).
6. End Connections: Socket.
7. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
8. Maximum Pressure Loss: 2 psig.
9. Rated Flow: 3 tons
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

L. Permanent Filter Dryers: Comply with AHRI 730.

1. Mueller Refrigeration is basis of design. Valves by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.
2. Body and Cover: Painted-steel shell.
3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
4. Desiccant Media: Activated [alumina] [charcoal].
5. Designed for reverse flow (for heat-pump applications).
6. End Connections: Socket.
7. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
8. Maximum Pressure Loss: 2 psig.
9. Rated Flow: 3 tons.
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

1. Refrigerant manufactured by Honeywell and DuPont is acceptable. Refrigerant by any manufacturer that meet or exceed performance specified below may be submitted for review by the engineer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with soldered joints.

B. Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.

C. Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type, or Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with soldered joints.

G. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with soldered joints.

H. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

I. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K or Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 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 Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

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 adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

S. 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."

T. 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."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE 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. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes rectangular and round, metal ducts for heating, ventilating, and air-conditioning systems in pressure classes from minus 2-inch w.g. to plus 10-inch w.g.

1.03 SYSTEM DESCRIPTION

A Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout would provide original design results without increasing system total pressure.

1.04 QUALITY ASSURANCE

A Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

A Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

C Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 SEALANT MATERIALS

A Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.

C Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.

2.03 HANGERS AND SUPPORTS

A Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.

B Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

C Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

D Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
E Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
F Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
G Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
H Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
I Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.

2.04 DUCT FABRICATION
A General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
B Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
C Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
D Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
(1) Supply Ducts: 1-inch w.g.
(2) Return Ducts: 1-inch w.g, negative pressure.
(3) Exhaust Ducts: 1-inch w.g, negative pressure.

PART 3 EXECUTION

3.01 DUCT INSTALLATION, GENERAL
A Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
B Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
C Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
D Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.

3.02 SEAM AND JOINT SEALING
A General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
B Pressure Classification Less Than 2-Inch w.g: Transverse joints.
C Seal externally insulated ducts before insulation installation.

3.03 HANGING AND SUPPORTING
A Install rigid round and rectangular, metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," latest edition.
B Support horizontal ducts within 24 inches of each elbow and within 48 inches of

each branch intersection.

C Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D Install concrete inserts before placing concrete.

E Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.04 CONNECTIONS

A Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," latest edition.

3.05 CLEANING

A After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

End

SECTION 233300 - DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes the following:

(1) Backdraft dampers.
(2) Manual-volume dampers.
(3) Fire dampers.
(4) Turning vanes.
(5) Duct-mounted access doors and panels.
(6) Flexible ducts.
(7) Flexible connectors.
(8) Duct accessory hardware.

1.03 QUALITY ASSURANCE

A NFPA Compliance: Comply with the following NFPA standards:
B NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

A Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

2.02 BACKDRAFT DAMPERS

A Description: Suitable for horizontal or vertical installations.
B Frame: 0.052-inch- thick, galvanized, sheet steel, with welded corners and mounting flange.
C Blades: 0.025-inch- thick, roll-formed aluminum.
D Blade Seals: Neoprene.
E Tie Bars and Brackets: Aluminum.
F Return Spring: Adjustable tension.

2.03 MANUAL-VOLUME DAMPERS

A General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
B Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
C Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
D Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated

for attaching to walls; and flangeless frames where indicated for installing in ducts.

E Roll-Formed Steel Blades: 0.064-inch- thick, galvanized, sheet steel.

F Blade Axles: Nonferrous.

G Tie Bars and Brackets: Galvanized steel.

2.04 FIRE DAMPERS

A General: Labeled to UL 555.

B Fire Rating: One and one-half hours.

C Frame: SMACNA Type B with blades out of airstream (unless indicated otherwise on drawings); fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.

E Minimum Thickness: 0.052 inch or 0.138 inch thick as indicated, and length to suit application.

F Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

G Mounting Orientation: Vertical or horizontal as indicated.

H Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized steel blade connectors.

I Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.

J Fusible Link: Replaceable, 165 deg F rated.

2.05 TURNING VANES

A Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," latest edition.

2.06 DUCT-MOUNTED ACCESS DOORS AND PANELS

A General: Fabricate doors and panels airtight and suitable for duct pressure class.

B Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

C Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

D Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.07 FLEXIBLE CONNECTORS

A General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 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 aluminum sheets. Select metal compatible with connected ducts.

2.08 FLEXIBLE DUCTS

A General: Comply with requirements on drawings and UL 181, Class 1.

B Flexible Ducts, Uninsulated: Corrugated aluminum.

C Flexible Ducts, Insulated (see drawings for insulation thicknesses).

D Reinforcement: Steel-wire helix encapsulated in inner liner.
E Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
F Outer Jacket: Polyethylene film.
G Inner Liner: Polyethylene film.
H Pressure Rating: 6-inch wg positive, 1-inch wg negative.

2.09 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 length to suit duct insulation thickness.
B Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
C Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.01 INSTALLATION
A Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
B Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
C Provide test holes at fan inlet and outlet and elsewhere as indicated.
D Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
E Install fusible links in fire dampers.
F Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
G Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
H Install access panels on side of duct where adequate clearance is available.
I Label access doors according to Division 23 Section "Mechanical Identification."

3.02 ADJUSTING
A Adjust duct accessories for proper settings.
B Adjust fire and smoke dampers for proper action.
C Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

End of Section

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators (exhaust fans).

2.01 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

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.

C. Field quality-control test reports.

D. Operation and maintenance data.

3.01 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. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

1.01 CENTRIFUGAL ROOF VENTILATORS

A. Basis-of-Design Product: See Drawings.

B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, galvanized steel, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing or in mechanical room (wall switch), factory/field wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Accessible speed controller for balancing.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches.
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Mounting Pedestal: Galvanized steel with removable access panel.

2.01 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

1.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

E. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

F. Install ducts adjacent to power ventilators to allow service and maintenance.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.01 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

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. Adjust damper linkages for proper damper operation.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
8. Shut unit down and reconnect automatic temperature-control operators.
9. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 23

SECTION 233600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fan-powered air terminal units.
   2. Shutoff, single-duct air terminal units.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: 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" and ASCE/SEI 7 SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems"

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 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: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 PRODUCTS

2.01 PARALLEL FAN-POWERED AIR TERMINAL UNITS

A. 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:
B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Environmental Technologies, Inc.
   2. Krueger.
   3. METALAIRE, Inc.
   4. Nailor Industries Inc.
   5. Price Industries.
   6. Titus.
   7. Trane; a business of American Standard Companies.
   8. Tuttle & Bailey.
C. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
D. Casing: 0.034-inch steel, single wall.
E. Casing Lining: Adhesive attached, 1-inch thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

F. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
G. Air Outlet: S-slip and drive connections.
H. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
I. Fan: Forward-curved centrifugal, located at plenum air inlet.
J. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
K. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
L. Maximum Damper Leakage: ARI 880 rated, [2] [3] percent of nominal airflow at 6-inch wg inlet static pressure.
M. Damper Position: Normally open.
N. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
O. Motor:
    1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    2. Type: Permanent-split capacitor with SCR for speed adjustment.
    3. Fan-Motor Assembly Isolation: Rubber isolators.
    4. Enclosure: Open dripproof.
    5. Efficiency: Premium efficient.
P. Motor Speed:
    1. Speed Control: Infinitely adjustable with electronic controls.
Q. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

    1. Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.
    2. Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.
    3. Thickness: 1 inch (25 mm).
R. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
    1. Location: Plenum air inlet.
    2. Stage(s): See drawings.
    3. Access door interlocked disconnect switch.
    4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
    5. Nickel chrome 80/20 heating elements.
    6. Airflow switch for proof of airflow.
    7. Fan interlock contacts.
    8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
        (a) Mercury contactors.
        (b) Magnetic contactor for each step of control (for three-phase coils).
S. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

T. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
U. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
V. Disconnect Switch: Factory-mounted, fuse type.
W. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
X. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.
Y. Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
    1. Occupied and unoccupied operating mode.
    2. Remote reset of airflow or temperature set points.
    3. Adjusting and monitoring with portable terminal.
    4. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

2.02 SERIES FAN-POWERED AIR TERMINAL UNITS
A. 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:
B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    1. Environmental Technologies, Inc.
    2. Krueger.
    3. METALAIRE, Inc.
    4. Nailor Industries Inc.
    5. Price Industries.
    6. Titus.
    7. Trane; a business of American Standard Companies.
    8. Tuttle & Bailey.
C. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling.
D. Casing: 0.034-inch steel single wall.
E. Casing Lining: Adhesive attached, 1-inch thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84..
F. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
G. Air Outlet: S-slip and drive connections.
H. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
I. Fan: Forward-curved centrifugal.
J. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
K. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
L. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.
    1. Damper Position: Normally open.

M. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.

N. Motor:
   1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   2. Type: Permanent-split capacitor with SCR for speed adjustment.
   3. Fan-Motor Assembly Isolation: Rubber isolators.
   4. Enclosure: Open dripproof.
   5. Efficiency: Premium efficient.
   6. Motor Speed:
      (a) Speed Control: Infinitely adjustable with electronic controls.

O. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

   1. Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.
   2. Thickness: 1 inch.

P. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
   1. Stage(s): See drawings.
   2. Access door interlocked disconnect switch.
   3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
   4. Nickel chrome 80/20 heating elements.
   5. Airflow switch for proof of airflow.
   6. Fan interlock contacts.
   7. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
   8. Mercury contactors.
   9. Magnetic contactor for each step of control (for three-phase coils).

Q. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

R. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.

S. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.

T. Disconnect Switch: Factory-mounted, fuse type.

U. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

V. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

W. Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
   1. Occupied and unoccupied operating mode.
   2. Remote reset of airflow or temperature set points.

3. Adjusting and monitoring with portable terminal.
4. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

2.03 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. Steel Cables: Galvanized steel complying with ASTM A 603.
D. 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.
E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.04 SEISMIC-RESTRAINT DEVICES

A. 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 .
B. 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 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; 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 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.

2.05 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.
B. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, electric heat and ARI certification seal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
C. Install wall-mounted thermostats.

3.02 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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.
C. Where practical, install concrete inserts before placing concrete.
D. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
E. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
F. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
G. Do not use powder-actuated concrete fasteners for seismic restraints.
H. Hangers Exposed to View: Threaded rod and angle or channel supports.
I. 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.

3.03 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." SCE/SEI 7.
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 air terminal units that are suspended with vibration isolators.
E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.
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 before 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. Install heavy-duty sleeve anchors 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.

3.04 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
D. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories."

3.05 IDENTIFICATION
A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.06 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
C. Tests and Inspections:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
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.
5. Air terminal unit will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports.

3.07 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.
C. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
D. Verify that controls and control enclosure are accessible.
E. Verify that control connections are complete.
F. Verify that nameplate and identification tag are visible.
G. Verify that controls respond to inputs as specified.

3.08 DEMONSTRATION
A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

End

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.03 DEFINITIONS

A Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C Register: A combination grille and damper assembly over an air opening.

1.04 QUALITY ASSURANCE

A Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A Provide diffusers, registers, and grilles as scheduled on Drawings.

2.02 SOURCE QUALITY CONTROL

A Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

3.01 EXAMINATION

A Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

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 practicable. For units installed in lay-in ceiling panels, locate units in the center

of the 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 connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.04 CLEANING

A After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

End of Section

PRODUCT SPECIFICATION GUIDE
MODEL RVE - PACKAGED ROOFTOP VENTILATORS WITH ENERGY RECOVERY WHEEL/HEATING/COOLING
CSI MASTERFORMAT CATEGORY 23 74 XX

****

****

PART 1 - GENERAL

1.1. SUMMARY

A. This section includes units with integral heating and cooling for outdoor installation. Integral Energy Recovery device shall be a rotary air-to-air total enthalpy wheel. Integral heat source shall be electric heat. Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air only. Each unit shall incorporate additional product requirements as listed in Section 2 of this specification.

B. Related Sections include the following:

1. Section 22 00 00: Scope of Work
2. Section 22 01 00: General Provisions
3. Section 22 07 00: Insulation
4. Section 22 10 00: Plumbing
5. Section 23 09 00: Controls and Instrumentation
6. Section 23 00 00: Electrical

1.2. SUBMITTALS

A. Product Data: For each type or model include the following:

1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA certified chamber.
2. Sound performance data for both Supply Air and Exhaust Air, as tested in an AMCA certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Performance ratings for all chilled water or DX coils.
5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
6. Estimated gross weight of each installed unit.
7. Installation, Operating and Maintenance manual (IOM) for each model.
8. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
9. Energy recovery performance data for both summer and winter operation.

10. Electric consumption data and construction specifications for electric heater, to include heat output, warranty and safety certifications.

1.3. QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Product Options: Drawings must indicate size, profiles and dimensional requirements of unit and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

D. End of line test with full report available upon request.

E. Certifications

1. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.
2. Energy Recovery Device shall be AHRI Certified, per Standard 1060.
3. Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05.

1.4. COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

B. Coordinate location of water system fittings to ensure correct positioning for connection to the water coil and condensate drain pipe.

C. Coordinate sequencing of construction of associated plumbing, HVAC, electrical supply, roofing contractor.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Greenheck Fan Corporation

2.2. MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, exhaust air blower, evaporator coil, energy wheel, hot gas reheat coil, packaged DX system, phase and brownout protection, motorized dampers, curb assembly, filter assembly intake air, supply air blower assembly, exhaust/relief blower assembly, filter assembly for exhaust air, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection

2.3. CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Unit’s exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours. Uncoated galvanized steel exterior is not acceptable.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Rigid urethane injected foam. Foam board not acceptable.
      a. Thickness: 2 inch (50.8 mm)
      b. Thermal Resistance R13
      c. Thermally broken
      d. Meets UL94HF-1 flame requirements.
      e. Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
   2. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
      a. Thickness: 2 inch (50.8 mm)
      b. Thermal Resistance R8
      c. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
      d. Location and application: Divider panels between outdoor air and return air/exhaust air streams.

C. Roof Insulation: 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.

D. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 22 gauge galvanized G90 steel or painted galvannealed steel.

E. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.

F. Exhaust Air blower assemblies: Blower assembly shall consist of an electric motor and a direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

G. Evaporator Coil: Evaporator coil shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

H. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch. Electric heater shall have single point power.

I. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

J. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.

K. Energy wheel: Unit energy wheel shall be sized for the full volume of outdoor and exhaust air without an energy wheel bypass damper(s). Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt or a link style belt with a five-year warranty.

The wheel media shall be a polymer film matrix in a stainless-steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and is designed and constructed to permit cleaning and servicing. The energy wheel is to have a five-year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

L. Reheat coil with factory installed modulating hot gas reheat valve.

M. Electric Post-heater: Post-heater shall be SCR control and shall include a temperature sensor with field adjustable set point, located in the outdoor air stream. Heat output of the post-heater shall be infinitely variable.

N. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Lead condenser fan shall have EC motor to maintain condenser pressure at part load conditions. Motors shall be UL Recognized and CSA Certified. The lead refrigerant compressor(s) shall be inverter hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Compressors shall be mounted within an insulated access compartment and on a raised cabinet shelf to reduce sound and vibration. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

O. Condenser Fans: Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point.] Motors shall be UL Recognized and CSA Certified. Single condenser fan running at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.

P. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm
3. Compressor Trip alarm
4. Compressor Locked Out alarm
5. Supply Air Temperature Low Limit alarm
    a. Sensor #1 Out of Range (outside air temperature)
    b. Sensor #2 Out of Range (supply air temperature)
    c. Sensor #3 Out of Range (cold coil leaving air temperature)

Q. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

R. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.

S. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture

penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 14 in.

T. Hail Guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.

U. 24V/120V Smoke detector: Duct smoke detector is shipped loose for field mounting and wiring in the supply or return air duct. The air duct smoke detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The air duct smoke detector housing shall be suitable for mounting indoors. The detector shall operate at air velocities of 100 feet per minute to 4000 feet per minute (0.5 to 20.32 meters/second). The power supply voltage shall be 20-29 VDC, 24 VAC 50-60 Hz, and 120 VAC 50-60 Hz. The detector shall consist of an alarm initiation contact and two DPDT auxiliary contact closures. WARNING: Duct smoke detectors are NOT a substitute for open area smoke detectors; NOT a substitute for early warning detection; NOT a replacement for a building's regular fire detection system. Refer to NFPA 72 and 90A for additional information.

2.4. BLOWER

A. Blower section construction, Supply Air: direct drive motors and blowers shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.

D. Blades: Welded aluminum blades only.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5. MOTORS

A. General: Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.

B. Motors shall be 60 cycle, 3 phase 460 volts.

2.6. UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

C. Unit supply fan shall be configured for Constant Volume (ON/OFF).

D. Unit exhaust fan shall be configured for Constant Volume (ON/OFF).

E. Outside Air / Return Air damper control shall be

F. Operating protocol: The DDC shall be factory-programmed for BACNetMSTP.

G. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be

factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

H. Unit shall be provided with a space thermostat measuring temperature. Thermostat shall have an LCD display and push buttons allowing for setpoint adjustments.

2.7. FILTERS

A. Unit shall have permanent 2 inch (50.8 mm) aluminum filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 8 disposable pleated filters shall be provided in the supply final air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.1. EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

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

3.2. INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3. CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

B. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.

C. Duct installation and connection requirements are specified in Division 23 of this document.

D. Electrical installation requirements are specified in Division 26 of this document.

3.4. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A / E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5. START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6. DEMONSTRATION AND TRAINING

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

SECTION 237433 - PACKAGED, OUTDOOR, HEATING AND COOLING MAKEUP AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes cooling and heating rooftop replacement-air units.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Include details of installation and wiring diagrams.

C. Coordination Drawings: Rooftop replacement-air units to roof-curb mounting details drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Size and location of rooftop replacement-air unit mounting rails and anchor points and methods for anchoring units to roof curb.
2. Required penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.

D. Startup service reports.

E. Operation and maintenance data.

F. Warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.

2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are listed on the drawings.

2.2 CABINET

A. Construction: Double wall.

B. Exterior Casing: Galvanized steel with baked-enamel paint finish and with lifting lugs and knockouts for electrical and piping connections.

C. Interior Casing: Galvanized or Stainless steel.

D. Base Rails: Galvanized or Stainless-steel rails for mounting on roof curb.

E. Service Doors: Hinged access doors with neoprene gaskets.

F. Internal Insulation: Fibrous-glass duct lining complying with ASTM C 1071, Type II.

1. Minimum Thickness: 1 inch.
2. Insulation Adhesive: Comply with ASTM C 916, Type I.
3. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

G. Condensate Drain Pans: Formed sections of plastic or stainless-steel sheet designed for self-drainage. Fabricate pans and drain connection to comply with ASHRAE 62.1-2004.

H. Roof Curb: Full-perimeter curb of sheet metal, minimum 14 inches high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.

I. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.3 SUPPLY-AIR FAN

A. Fan: Internally isolated, backward curved, direct drive, centrifugal plenum; statically and dynamically balanced, galvanized or coated steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings.

B. Motor: VFD controlled invertor duty.

C. Drive: direct

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric, rubber, or spring isolators.

2.4 REFRIGERATION SYSTEM

A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

B. Compressors: Reciprocating or scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

C. Minimum Efficiency: As defined by ASHRAE/IESNA 90.1-2019, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Refrigerant: R-410A

E. Refrigeration System Specialties:

1. Expansion valve with replaceable thermostatic element.
2. Refrigerant dryer.
3. High-pressure switch.
4. Low-pressure switch.
5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
6. Brass service valves installed in discharge and liquid lines.
7. Operating charge of refrigerant.

F. Capacity Control: Hot-gas bypass refrigerant control for capacity control with continuous dehumidification on a single compressor.

G. Capacity Control: Patented, Rawal APR control with zero to 100 percent modulating capacity control using hot-gas bypass. Evaporator coil shall be continuously active for dehumidification.

H. Capacity Control: Single compressor with evaporator and condenser coil within the refrigerant section to provide initial precooling and reheat for humidity control.

I. Capacity Control: Heat-pipe heat exchanger shall wrap around the evaporator coil to precool the air entering the evaporator coil, and reheat the air leaving the evaporator coil to control humidity.

J. Refrigerant Coils: Evaporator, condenser, and reheat condenser coils shall be designed, tested, fabricated, and rated according to ARI 410 and ASHRAE 33. Coils shall be leak tested under water with air at 315 psig.

1. Capacity Reduction: Circuit coils for interleaved control.
2. Tubes: Copper.
3. Fins: Aluminum or Copper with minimum fin spacing of 0.071 inch.
4. Fin and Tube Joint: Mechanical bond.
5. Suction and Distributor: Seamless copper tube with brazed joints.
6. Coating: Phenolic epoxy corrosion-protection coating on both coils.
7. Source Quality Control: Test to 450 psig, and to 300 psig underwater.

K. Condenser Fan: Propeller type, directly driven by motor.

L. Safety Controls:

1. Compressor motor and outside-coil fan motor low ambient lockout.
2. Overcurrent protection for compressor motor and outside-coil fan motors.

2.5 INDIRECT-FIRED GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."

1. AGA Approval: Designed and certified by and bearing label of AGA.

B. Burners: Stainless steel

1. Minimum AFUE: 80 percent.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark with flame sensor.

C. Heat-Exchanger Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

F. Safety Controls:

1. Gas Control Valve: Electronic modulating.
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 OUTDOOR-AIR INTAKE AND DAMPERS

A. Dampers: Leakage rate, according to AMCA 500, shall not exceed 2 percent of air quantity at face velocity of 2000 fpm through damper and pressure differential of 4-inch wg.

B. Damper Operators: Electric.

C. Mixing Boxes: Parallel-blade, galvanized-steel dampers mechanically fastened to steel operating rod inside cabinet. Connect operating rods with common interconnecting linkages so dampers operate simultaneously.

D. Outdoor-Air Intake Hoods: Galvanized or Stainless steel, with bird screen complying with ASHRAE 62.1-2004 and finish to match cabinet.

2.7 FILTERS

A. Comply with NFPA 90A.

B. Disposable Panel Filters: Minimum MERV 8.

1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
2. Frame: Galvanized steel.

2.8 CONTROLS

A. Factory-wire connection for controls' power supply.

B. Control devices, including sensors, transmitters, relays, switches, thermostats, humidistats, detectors, operators, actuators, and valves, shall be manufacturer's standard items to accomplish indicated control functions.

C. Unit Controls: Solid-state control board and components with field-adjustable control parameters.

D. Supply-Fan Control: Units shall be electrically interlocked with corresponding exhaust fans, to operate continuously when exhaust fans are running. Time clock shall switch operation from occupied to unoccupied. Night setback thermostat shall cycle fan during unoccupied periods to maintain space temperature.

1. Timer: Seven-day electronic clock.
2. Electrically interlock kitchen hood fire-extinguishing system to de-energize replacement-air unit when fire-extinguishing system discharges.

E. Remote-Mounted Status Panel:

1. Cooling/Off/Heating Controls: Control operational mode.
2. Damper Position: Indicates position of outdoor-air dampers in terms of percentage of outdoor air.
3. Status Lights:

    a. Filter dirty.
    b. Fan operating.
    c. Cooling operating.
    d. Heating operating.

F. Refrigeration System Controls:

1. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air enthalpy is less than 28 Btu/lb of dry air or outdoor-air temperature is less than 60 deg .
2. Outdoor-air sensor de-energizes dehumidifier operation when outdoor-air temperature is less than 60 deg F.
3. Wall-mounting, relative-humidity sensor energizes dehumidifier operation when relative humidity is more than 60 percent.

G. Heating Controls:

1. Factory-mounted sensor in supply-fan outlet with sensor adjustment located in control panel modulates gas furnace burner to maintain space temperature.
2. Wall-mounting, space-temperature sensor with adjustment on remote-control panel that modulates gas furnace burner to maintain space temperature.

H. Integral Smoke Alarm: Smoke detector installed in supply air prior to any takeoffs.

2.9 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and secure rooftop units on curbs on grade mounted equipment pads and coordinate wall penetrations and flashing with GC.

B. Install wall- and duct-mounting sensors, thermostats, and humidistats furnished by manufacturers for field installation. Install control wiring and make final connections to control devices and unit control panel.

C. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Install piping adjacent to machine to allow service and maintenance.

1. Gas Burner Connections: Comply with requirements in Division 23 Section Facility Natural-Gas Piping. Connect gas piping to burner, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.

E. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to rooftop replacement-air units with flexible duct connectors.

F. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.2 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions.

B. Prepare written report of the results of startup services and provide to owner.

3.3 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop replacement-air units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237433

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting and may be connected to ducts.

1.02 SUBMITTALS

A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and maintenance data.

1.03 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2016, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2016 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2016, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the are listed on drawings.

2.02 EVAPORATOR-FAN UNIT

A. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

(1) Insulation: Faced, glass-fiber duct liner.

(2) Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2016.

(3) Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.

B. Floor-Mounting, Unit Cabinet: Enameled steel with removable panels on front and ends.

(1) Insulation: Faced, glass-fiber, duct liner.

(2) Drain Pans: Galvanized steel, with connection for drain; insulated [and complying with ASHRAE 62.1-2016.

(3) Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

D. Electric Coil: Helical, nickel-chrome, electric-resistance 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 with SCR control.

E Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

F Fan Motor: Multi-speed.

G Filters: 2” Pleated, 30% efficient. Minimum MERV 8.

2.03 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A Casing steel, finished with baked enamel, 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.

B Compressor: Hermetically sealed reciprocating scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

C Refrigerant: R-410a.

D Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

E Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

F Fan: Aluminum-propeller type, directly connected to motor.

G Motor: Permanently lubricated, with integral thermal-overload protection.

H Low Ambient Kit: Permits operation down to 25 deg F.

I Mounting Base: Polyethylene.

J Minimum Energy Efficiency: Comply with 2012 IECC.

2.04 ACCESSORIES

A Thermostat/Humidistat: Low voltage with subbase to control compressor and evaporator fan.

B 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.

C Wall mount kits: Provide wall manufacturer wall mount kit with appropriate fasteners for the substrate of the wall where the condenser unit is mounted. Coordinate with architectural drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

B Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

C Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

E Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.02 CONNECTIONS

A Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

B Install piping adjacent to unit to allow service and maintenance.

3.03 FIELD QUALITY CONTROL

A Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

End of Section

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 REFERENCE TO OTHER SECTIONS

A General Conditions: Refer to the GENERAL CONDITIONS and GENERAL REQUIREMENTS for items that affect the work or administration of the work under DIVISION 26 - ELECTRICAL.

B General Provisions: Electrical GENERAL PROVISIONS - specified herein-apply to all Sections of DIVISION 26 - ELECTRICAL.

1.02 DEFINITIONS

A Terms:

1. The following definitions of terms supplement those of the GENERAL CONDITIONS and are applicable to DIVISION 26 - ELECTRICAL:
   a. "Provide" shall mean "furnish, install and connect complete".
   b. "Wiring" shall mean "wire or cable, installed in raceway with all required boxes, fittings, connectors and accessories; completely installed".
   c. "Work" shall be understood to mean "the materials completely installed, including the labor involved".
   d. "Plans" shall be understood to mean "the complete set, including all trades".
   e. "Specifications" shall be understood to mean "the complete documents, including all sections, addenda items, etc."
   f. "Review of Shop Drawings": The Architect's and Engineer's review shall not change the requirements of the contract documents nor shall this review relieve the Contractor of errors in shop drawings. In the event there are deviations between the shop drawings and the contract documents, the contract documents shall apply.

B Drawings:

1. The contractor shall specifically note that the electrical drawings are intended to indicate only the extent diagrammatically, general character and location of work included. Work intended but having minor details obviously omitted or not shown shall be furnished and installed complete to perform the required function. The equipment, conduit and device locations are approximate and any changes necessary to clear obstructions shall be made as approved by the Owner and at no additional cost to the Owner.
2. For building details, the architectural drawings and specifications shall be followed and the work of the electrical drawings and specifications shall be coordinated and fitted thereto.
3. It shall be the responsibility of the contractor to obtain a copy of the Interior Work drawings for location of furniture, counters, etc., for the locating of electrical convenience. Any outlets not located properly will be relocated to the complete satisfaction of the Architect at no additional cost to the Owner. Any questions arising as to locations, etc., will be directed to the Architect.
4. The contractor shall review the drawings and specifications and should he find discrepancies, conflicts or omissions in the documents or be in doubt as to the intent thereof, he shall immediately obtain clarification from the Architect/Engineer prior to submitting his proposal for work in this Division.

C Materials:

1. All materials used in this work shall be new and shall bear the inspection label of Underwriters Laboratories, Inc.

2. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standard Institute, the Institute of Electrical and Electronic Engineers and the American Society of Testing Materials, are made a part of this Specification and shall apply wherever applicable.
3. Catalog numbers and trade names in these Specifications and noted on the drawings are intended to describe the materials, devices or apparatus required. Within thirty days after the contract has been awarded or as otherwise directed, forward to the Engineer a complete list of all materials and equipment proposed for installation. List shall include sufficient information to permit ready and complete identification.

1.02 CODES, PERMITS AND ORDINANCES

A Code:

1. The installation included under this DIVISION shall comply with the 2020 of the National Electrical Code, the Electrical Code of the Municipality having jurisdiction and State and Federal laws and regulations.
2. Referenced Codes and regulations are minimum standards. Where the requirements of these Specifications and the accompanying drawings exceed those of the codes and regulations, the drawings and specifications shall be followed.
3. The contractor shall obtain permits and licenses required for the installation of the work and shall pay all fees therefor.
4. At the completion of the work, the contractor shall obtain from the Local Building Authority a Certificate of Approval. This certificate shall be turned over to the Owner at the close of job.
5. In preparing his bid, the contractor shall carefully check the plans and specifications for compliance with applicable codes and other legal requirements. He shall inform the engineer, in writing, of any non-conformance before he submits his bid.

1.03 VISIT TO SITE

A All bidders shall visit the site and carefully examine the existing conditions before submitting bids, as no allowance will be made for lack of knowledge of existing conditions, where such conditions may reasonably be determined by observation.

1.04 SUBMITTALS

A Procedure: Refer to the GENERAL CONDITIONS and supplements thereto for submittal procedure of items called for in the Contract Documents.

B Shop Drawings:

1. Shop drawings shall be submitted in accordance with the following:
2. All shop drawings shall be submitted after being checked and certified by the contractor that they comply with drawings and specifications.
3. The contractor shall be responsible for all dimensions and quantities.
4. Contractor's submittal shall include a list of the manufacturers of the principal items of material: Wire, raceways, devices, boxes, panelboards, connectors, etc. Full information shall be furnished on products of manufacturers not named in the Specifications.
5. Submittals shall be detailed in technical content to allow for adequate review. Information shall be furnished for all accessories and options required for a complete installation.
6. Submittals which are prepared by manufacturers or vendors shall be completed by the contractor to include any additional materials or work required to complete the installation. Lighting fixtures shall have complete

information on the type, wattage, color and manufacturer for each lamp required. The term "by others" or "by Contractor" shall not be included in any submittal.

7. Submittals which do not comply with all of the requirements of this Section will be returned without review.

C Shop Drawings List:

1. Submit detailed shop drawings and/or catalog data for the following equipment for review:
   a. Circuit breakers
   b. Panelboards
2. Lighting Fixtures
3. Lighting Control System

D The following items of equipment and materials shall be submitted for approval by reference to the manufacturer and specific catalog and model number:

1. Safety switches
2. Receptacles, switches, plates and devices
3. Large junction boxes
4. Lamps
5. Fuses

1.05 WORKMANSHIP AND APPROVAL

A Work under this Section shall be performed by skilled and qualified electricians. Work shall be subject to constant inspection and final approval by the Architect. Any inspections or approvals shall not relieve the contractor of responsibility for compliance with any and all requirements of the Contract documents.

1.06 GUARANTEE, CORRECTION OF WORK AFTER ACCEPTANCE

A Specific attention is called to DIVISION 1 - GENERAL CONDITIONS on these subjects.

1.07 RECORD DRAWING PRINTS

A Shall be submitted to the Architect at completion of the work.

B Shall be one blueline print of the Contract Drawings on which have been marked in red all additions of outlets and equipment to the original design and all relocations of outlets, raceways and equipment.

1.08 MAINTENANCE DATA

A Furnish and deliver at final inspection complete copies of all data prepared by manufacturers detailing operation and maintenance instructions on all equipment requiring maintenance.

1.09 PAINTING

A Equipment and materials not provided with factory-applied finish shall be painted as described in another Division of these Specifications. Electrical work which will be job-painted shall be clean of dirt, grease, rust, cement and plaster.

B Equipment with a factory-applied finish shall have scratches, discoloration, chips, etc., repaired and refinished to the satisfaction of the Architect.

PART 2 PRODUCTS

2.01 MATERIAL

A All material, apparatus and equipment shall be new and shall bear the label of the Underwriters Laboratories, Inc., where such labels are available.

2.02 MOTOR HORSEPOWER

A The horsepower of motors indicated on the plans is the estimated horsepower requirements of equipment furnished under other sections of the specifications. All wiring, feeder protection devices and disconnect devices shall be of the size and ampacity for the horsepower of the respective motor actually installed. However, in no case shall these items be of smaller capacity than those indicated on the drawings. The contractor shall coordinate with the other trades and provide suitable equipment so that the above requirements shall be met without any additions to the contract price.

2.03 PROTECTION OF MATERIALS

A Keep all conduit and other openings protected to prevent entry of foreign matter. Cover fixtures, equipment and apparatus for protection against dirt, water, chemical or mechanical damage before and during construction. The original finish, including shop coat of paint on fixtures, apparatus or equipment that has been damaged shall be restored prior to final acceptance.

2.04 UNIT RESPONSIBILITY

A All distribution, lighting and appliance panelboards shall be the unit responsibility of one manufacturer. All component parts of the above listed items shall be of the same manufacturer, except where a written request for a deviation from this requirement has been approved prior to bid date.

2.05 DEVIATIONS

A No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect.

B Should the Contractor find, at any time during the progress of the work, that, in his judgment, existing conditions make desirable a modification in requirements covering any particular item or items, he shall report such items promptly to the Architect for his decision and instructions.

2.06 REJECTION OF MATERIALS

A The Architect shall have the authority to reject any material, equipment or workmanship not complying with these Specifications; and the Contractor shall replace defective work or materials immediately upon notification of rejection. Any material so rejected shall be removed from the job within 24 hours of such rejection; otherwise, the Architect may have same removed at the Contractor's expense.

END OF SECTION 260500

SECTION 260501 - SCOPE OF THE WORK - ELECTRICAL

PART 1 GENERAL

1.01 WORK INCLUDED

A Work under this Section shall include the furnishing of all articles, materials, labor, supervision and services required for the installation of electrical systems in this project.

B All systems and equipment shall be installed complete and fully operative.

C Electrical connections and power supplies shall be provided to all Division 22 & 23 equipment and other equipment or equipment furnished by Owner. Subcontractor shall be responsible for reviewing the Architectural, Mechanical and Plumbing Drawings and Specifications to identify all equipment.

1.02 TEMPORARY FACILITIES

A Provide and pay costs for the installation of temporary electric service and lighting a stated in DIVISION 1 - GENERAL CONDITIONS.

1.03 CONNECTIONS TO OTHER EQUIPMENT

A All air conditioning, plumbing, heating equipment and security electronics requiring electrical power shall be fully connected electrically and ready for operation. All power wiring for the aforementioned shall be furnished and installed under DIVISION 26 of the work.

B Air conditioning control and interlock wiring will be furnished and installed as part of DIVISION 22 work, unless hereinafter specified or indicated on the Electrical Drawings.

C Motor control in designated air conditioning units will be factory installed and wired. Connect indicated power circuits to terminals provided in units through disconnect switches mounted at units.

D All other motor control will be individual devices furnished under DIVISION 22 unless specifically shown on the electrical drawings; installed and wired under DIVISION 26.

E Wire to exhaust fan unit terminals through fire stats and motorized shutters or dampers furnished and mounted as DIVISION 22 work, unless specifically shown on Div 26 drawings.

F Individual protective devices (circuit breakers and fusible switches) not factory installed in mechanical equipment shall be furnished and installed as DIVISION 26 work.

G Disconnect switches shall be furnished and installed as DIVISION 26 work, as indicated and as required by codes.

H Capacities indicated for mechanical equipment and branch circuits and feeders for same indicated on the drawings are based on information furnished on equipment specified. All equipment characteristics shall be verified as indicated and capacities increased accordingly where required.

1.04 IDENTIFICATION

A Install, as hereinafter specified, an engraved laminated white core nameplate engraved with usage or identification of the device or equipment.

B Affix nameplates with rustproof screws or epoxy cement.

C Embossed tape strips shall not be used.

D Panelboard directory identification cards shall be typed to indicate loads served. Spare breakers shall be noted in pencil.

1.05 COORDINATION

A Before any piping, raceway, ductwork, outlets, equipment or lighting fixtures are located in any area; coordinate the space requirements of all trades. Such shall be arranged so that space conditions will allow all trades to install their work and will also permit access for future maintenance and repair.

B Piping, ductwork, raceways and equipment installed at variance with the above requirements shall be relocated and/or revised to conform to those requirements at no added cost to the Owner.

C Space conditions and conflict problems which cannot be resolved by the Contractor shall be referred to the Architect.

D The electrical installation shall proceed as fast as the remainder of the construction will permit. Schedule the electrical work so that completion of the Project will not be delayed.

END OF SECTION 260501

SECTION 260502 - BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A Description of Systems: This Section encompasses products, assemblies and methods which are required by more than one of the project systems encompassed by the Sections of DIVISION 26.

B Other items of basic materials and methods are specified in the following Sections:

1.	"RACEWAYS"	SECTION 26 0533
2.	"CONDUCTORS"	SECTION 26 0519
3.	"OUTLET BOXES"	SECTION 26 0534
4.	"WIRING DEVICES"	SECTION 26 2726
5.	"DISCONNECTS"	SECTION 26 2817
6.	"SUPPORTING DEVICES"	SECTION 26 0529

1.02 QUALITY ASSURANCE

A Design Criteria:

1. All apparatus for the various systems shall be of proper rating for the voltage of the systems.
2. All equipment components shall be of such physical size to be easily introduced into the space available in the building.
3. All equipment shall readily fit in the spaces indicated on the drawings. If any equipment proposed is of larger size than the design selection or involves larger controls or any contingent difference which requires additional space, its use is not permitted.

PART 2 - PRODUCTS

2.01 WOOD BACKBOARDS

A Wood: Backboards shall be made of 3/4" Grade B-C plywood.

B Paint: Backboards shall be painted with two (2) coats of fire inhibiting gray finish.

2.02 NAMEPLATES

A Provide laminated black, white core bakelite nameplates for all devices. Letters on nameplates shall be block style, of height as specified herein.

B The following letter size shall be provided for each piece of the following equipment:

1.	Service Switchboard	
2.	Designation:	1/2"
3.	Voltage:	1/4"
4.	Switches in Switchboard:	1/4"
5.	Branch Circuit Panelboards -	
6.	Designation:	1/2"
7.	Voltage:	1/4"
8.	Safety Switches:	1/4"
9.	Enclosed Circuit Breakers:	1/4"
10.	Starters:	1/4"

2.03 SPARE FUSES

A 25% of each type and rating shall be provided for spares with a minimum of two and a maximum of six for each type and rating.

B Fuses shall be turned over to Owner at completion of job.

PART 3 - EXECUTION

3.01 CUTTING AND REPAIRING

A Refer to the DIVISION 1 - GENERAL CONDITIONS.

B Provide all sleeves required for proper installation of work included under this heading.

3.02 EXCAVATION AND BACKFILLING

A Do all trenching, excavation and backfilling required for the electrical work indicated on the Drawings, including repairing, shoring, bracing and pumping.

B Backfilling shall be done in layers of 12" fill, wetted down and tamped for each consecutive layer to grade. Refer to another Division for compaction requirements.

C Repairing shall be comparable to work cut and shall have final approval of authorities having jurisdiction.

D Contractor shall locate and avoid any existing facilities during excavation and shall give written notification of any unforeseen conditions.

3.03 NAMEPLATES

A Starters and Controllers: Provide nameplates for each individually enclosed circuit breaker, safety switch and for each starter or controller. The usage of each switch and starter shall be etched on the plate and the plate mounted on the switch and starter cover after all painting has been completed.

B Service Switchboard and Branch Circuit Panelboards: Provide nameplates for the service switchboard and branch circuit panelboards with the designation shown on the drawings etched on the plate along with the supply voltage rating to the equipment mains. Provide nameplates on the service switchboard indicating the usage for each fusible switch and/or circuit breaker.

C Sheet metal screws or epoxy shall be used as the means of affixing nameplates to their respective devices.

3.04 WOOD BACKBOARDS

A Telephone Equipment: Provided by Division 17000.

B Power Backboards: Provide as required for power equipment. Mount starters, breakers, gutters or other apparatus indicated on the backboards.

C Wiring on wood backboards shall be done in screw-cover wireways and rigid galvanized steel conduit.

D Fasten to wall with 1/4 inch or larger toggle bolts on concrete block walls or with bolts in expansion shields or preset inserts, in poured concrete walls with 1/2" spacers between wall and board.

3.05 APPARATUS CONNECTIONS

A Where connection is to be made to an item of equipment, such as a motor, which is not located near a wall or column, a vertical conduit attached to the floor and ceiling shall be installed and the wiring brought out of this conduit by means of condulets.

B Connections to vibrating equipment, such as motors, duct heaters, etc., shall be made with a short length of liquid tight flexible conduit eighteen (18) inches minimum and thirty six (36) inches maximum, in length.

3.06 FINAL TESTS

A Extent of Testing: Upon completion of the work, test the individual systems, including all feeders, service, branches, outlets, lighting motors, apparatus and appliances.

B Equipment: Provide all instruments, labor and materials required for any essential intermediate and final tests designated.

C Results: Tests shall indicate full compliance with specifications, drawings and applicable codes. All tests will be observed by the Owner's representative.

END OF SECTION 260502

SECTION 260519 - CONDUCTORS

PART 1 GENERAL

1.01 DESCRIPTION

A Description of System: Provide a complete system of wiring with all feeders and branches as shown on the drawings. The wiring system shall be complete to each and every outlet and apparatus shown on the drawings which requires electrical connections.

1.02 QUALITY ASSURANCE

A Acceptable Manufacturers: Wire shall be Crescent, General Cable, Rome, Triangle, Okonite, Pirelli or Southwire.

B Standards: Specified conductor gauge sizes refer to American Wire Gauge.

PART 2 PRODUCTS

2.01 CONDUCTORS

A Conductor Material: Conductors shall be copper, 98.5% conductivity.

B All new wire and cable routed in conduits shall have copper conductors and shall have 600 volts NEC Type THWN or THHN insulation for branch circuits and Type XHHW for feeders.

C All branch circuits for lighting, receptacles and PTAC units will utilize THHN" type cable with grounding conductor.

D Wire #8 AWG and larger shall have stranded conductors. Wire #10 AWG and smaller shall be solid conductor type.

E No wire shall be smaller than #12 AWG, unless otherwise specified.

F Branch circuit wiring which supplies more than one fluorescent fixture through the wiring of other fixtures shall be 90°C, insulation Type THHN or TFFN.

G Cable pulling compound shall be the type manufactured for use with plastic insulated wires. Yellow #77 or equal.

2.02 ACCESSORIES

A Wire Joints: T & B "Sta-Kon", "Scotchlock Type R", Ideal #452 or 454, Buchanan "B-Cap".

B Cable Connectors: Solder less type, O.Z. "circular clamp type" or T & B "lock-tite" appropriate for the particular application involved. Two-way connectors and "T-Taps" shall have molded thermoplastic covers.

PART 3 EXECUTION

3.01 PREPARATION

A Lubricant: No grease, oil or lubricant other than powdered soapstone, or approved pulling compound, shall be used to facilitate the pulling of wires.

B Raceway: Raceways shall be free of concrete, moisture or other foreign matter. Raceways shall be swabbed as necessary before pulling wire.

3.02 INSTALLATION

A Complete electrical systems shall be provided as shown on the drawings and/or as specified herein.

B Wires shall be pulled without excessive strain to prevent damage to conductor or insulation.

C Each raceway or cable indicated by symbol on drawings shall contain #12 AWG wires as indicated.

D Branch circuit designations, as shown on the plans, are arbitrary and each circuit of multi-circuit home run shall be connected to a different phase of the distribution panel to balance the load within 10%.

E Cable pulling compound shall be used in raceways.

F No wire shall be smaller than #12, unless otherwise specified.

G At each fixture or device outlet a loop or end of wire not less than eight inches long shall be left for connection to fixture or device.

H Wire in capped outlets shall have ends taped.

I Splices, taps and connections shall be made up as follows:

1. Wire sizes #8 AWG and smaller with mechanical connectors.
2. Wire and cable of sizes #6 AWG and larger, with mechanical or indent connectors. Indent connectors are preferred on 350 MCM and 500 MCM sizes.

J Joints shall be covered with 7 mil thick electrical tape on branch circuit wiring connections and 10 mil thick electrical tape on mechanical and indent connectors on larger cables.

K All wire shall be color coded to indicate the various phases and neutral. Where color coding is impractical, approved 3/4" wide tape bands, corresponding to Color Code, N.E.C. SECTION 210-5, shall be provided.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 DESCRIPTION

A This Section specifies the requirements for supplemental ground fields, system grounds and equipment grounds.

1.02 REGULATIONS

A Minimum requirements for grounding shall be the National and Local Electrical Codes.

PART 2 PRODUCTS

2.01 GROUND CONDUCTORS

A Provide all conduits with a separate green insulated grounding conductor for feeders and branch circuits. Unless otherwise specified or indicated, the ground conductor shall be a #12 AWG "THWN" as a minimum.

B Unless otherwise indicated, all other ground leads shall be 600 volt N.E.C. Type "THWN".

2.02 CONNECTIONS

A Connections in the supplemental ground field shall be made using a thermo weld process (Cad weld, or equal).

B Other grounding connections shall be made with bonding clamps approved for the purpose.

PART 3 EXECUTION

3.01 GROUNDING SYSTEM

A A building grounding system, consisting of driven ground rods and interconnecting copper wiring, with bonding connections to cold water entrance pipe and ground bus in service switchboard, shall be provided as indicated on the drawings.

B A supplemental ground field, as required by Art. 250-81, N.E.C., shall be bonded to the ground bus in the main Service Switchboard.

3.02 EQUIPMENT AND SYSTEM GROUNDS

A All electrical equipment enclosures and conductor enclosures shall be grounded. All locknut connections to cabinets, pull boxes, junction boxes, etc., shall be wrench tight, with locknut projection driven into the opposing metal surfaces.

B A bonding jumper shall be installed inside of each flexible conduit on motor and mechanical equipment circuits. Jumper shall bond from outlet box at origin of flexible conduit to outlet box or equipment at its termination. It shall be sized according to Table 250-95, N.E.C.

C Provide a grounding conductor (#6 AWG) for each telephone and television backboard to the nearest accessible effectively grounded cold water pipe or service ground for Telephone Company's ground.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies the requirements for supporting or mounting of work installed under this Division.

1.02 QUALITY ASSURANCE

A. Design Criteria: Materials employed for support shall be of a type manufactured and approved for the intended application.

B. Published Data: Upon request, furnish data published by the manufacturer indicating load-bearing capacity and approved usage of the support.

PART 2 PRODUCTS

2.01 CONCRETE INSERTS

A. Grinnell "CB-Universal" or Hohmann & Barnard "HA" (or larger).

2.02 CONCRETE ANCHORS

A. Philips "Red Head" or USM Corporation "Molly Parabolt".

2.03 STEEL FRAMING

A. Kindorf or Unistrut steel channel or angle, with accessory fittings.

B. Cable Clamps: Russell Stoll or O.Z.

PART 3 EXECUTION

3.01 GENERAL

A. Locate and install all inserts in the new construction before slabs are poured.

B. Spacing of support and sizes of supports shall be governed by the load to be supported.

C. Working load of supports shall be based on a safety factor not less than 4:1.

D. Spacing intervals shall not exceed those required by the National Electrical Code.

E. Exterior building walls below grade shall not be pierced by hanger bolts.

3.02 CONDUIT SUPPORT

A. Individual conduits shall be hung using Kindorf 6H conduit straps with threaded rods or stud anchors.

B. Multiple conduits shall be installed on gang hangers using channel iron with Kindorf C-105 straps.

3.03 CABLE SUPPORTS

A. Install cable supports in vertical conduit risers at intervals prescribed by the National Electrical Code.

B. Lace up cables to supports in switchboards using "Ty-wraps".

3.04 WOOD BACKBOARDS

A. Mount wood backboards on walls using 1/4" or larger toggle bolts or anchors and

1/2" spacers between wall and board.

3.05 OTHER EQUIPMENT

A Mount other equipment as required using inserts or anchors of adequate size and spacing.

B Comply with manufacturer's recommended mounting method.

3.06 GROUTING

A Fill any voids left in inserts with grout.

END OF SECTION 260529

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.01 DESCRIPTIONS

A Description of System: Provide raceways and conduit indicated on the drawings, complete with all required accessories, hangers, supports, connections and fittings necessary to make the system complete. All raceway must be concealed, except in electrical/mechanical rooms.

B Definitions:

1. Concealed Conduit: Conduit installed above suspended ceilings or within columns, slabs or walls.
2. Exposed Conduit: Conduit exposed to view.

1.02 QUALITY ASSURANCE

A Acceptable Manufacturers:

1. Metallic Conduit: Triangle, Allied, Wheatland, Pittsburgh Standard, Jones and Laughlin, Youngstown or Wheeling-Pittsburgh.
2. Non-Metallic Conduit: Carlon.
3. Surface Metal Raceways: Walkerduct, Wiremold or Airey-Thompson.
4. Flexible Metal Conduit:
   a. Greenfield (flexible metal conduit with no cover)
   b. Anaconda (liquid-tight conduit with PVC cover)

1.03 JOB CONDITIONS

A Protection: Secure conduits in place and protect where necessary to prevent damage to the work during construction. Plug ends of all conduit runs with cork or oakum to avoid filling with mortar, etc.

B Sequencing, Scheduling: The layout of conduit is diagrammatic only and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made as approved by the Architect and without any additional cost to the Owner.

PART 2 PRODUCTS

2.01 METALLIC CONDUIT

A Material: Conduit shall be of best quality steel, of standard pipe size, smooth inside and out and shall be hot dipped galvanized or sherardized.

B Rigid Steel Conduit:

1. Fittings and couplings shall be hot dipped galvanized or sherardized. Aluminum alloy fittings shall not be used.
2. Make threaded joints in exposed conduit with anti-seize compound applied to the male threads only.
3. Use Bakelite, insulated bushings with separate locknuts on all rigid conduits entering panel cabinets, outlet boxes, etc.
4. All connections in areas exposed to weather shall be made using watertight hubs.

C Thinwall Steel Conduit (Electrical Metallic Tubing):

1. All E.M.T. entering panel cabinets, outlet boxes, etc., shall be provided with an all steel insulated throat connector.
2. Connectors, couplings and fittings for electrical metallic tubing shall be UL approved as raintight and concrete tight, of the interlocking compression-ring type. Each connector shall have a factory-installed

insulated throat bushing.

D Flexible Conduit: Flexible conduit shall be single strip, shall have bonding jumper installed inside all flexible conduits and shall be bonded beyond each end of the flexible conduit to provide ground continuity.

E Liquidtight Flexible Conduit: Anaconda "Sealtite," Type "EF," PVC jacketed flexible metal conduit.

F Expansion Fittings: Provide expansion fittings with bonding jumpers in conduit at building expansion joints.

G NON-METALLIC CONDUIT

1. Material: Carlon Type 40 heavy wall rigid "PV-Duit" polyvinyl chloride conduit.
2. Accessories: Fittings, couplings, bends, etc., shall be Carlon manufacturer.

2.02 SMOKE AND FIRE-STOP METHODS

A Openings in floor slabs or fire rated walls and ceilings through which cables, conduits or piping must pass shall be sealed by U.L. recognized fire barrier assembly with a rating equal to or greater than the rating of the wall, floor or ceiling which is penetrated. Such penetrations are not specifically indicated on the drawings and shall be located and verified by the Contractor.

B The method utilized for construction and installation of fire stops and barriers shall be in strict accordance with details and directives described in the U.L. Building Materials Directory, 1984.

C The materials utilized for construction of fire stopping and barriers shall be commercially manufactured caulks, wrapping, foams or strips, installed specifically per the manufacturers U.L. approved instructions. Materials shall be by 3M, Chase Technologies Corporation or Dow Corning.

D Only E.M.T. or rigid steel conduit or I.M.C. shall be used for any penetration of fire rated construction, except as noted on drawings.

E Interiors of large empty raceways for computer cables shall be filled with a fire sealant foam which remains soft, pliable and self-sealing throughout its life.

PART 3 EXECUTION

3.01 LOCATION

A Layout: In general, the conduit installation shall follow the layout indicated on the drawings.

B Conduits will be utilized only as indicated on plans.

a. Conduit sleeves shall be used thru fire walls.
b. Conduit will be used for vertical runs in blocks in cells of stair wells and elevator shaft.
c. Conduit will be utilized for circuits that have large size conductors (individual) in lieu of "NM" cable.

C Generally all conduits shall be concealed, unless otherwise directed or indicated on the drawings.

D Offsets in conduits are not indicated and must be furnished as required.

E Schedule:

1. Metal conduit shall be used as a raceway system only as indicated for all wiring, except as specified otherwise herein or otherwise shown on drawings.
2. Non-metallic conduit shall be used where non-metallic conduit or plastic conduit (PVC) is specified herein or shown on the drawings. At the Contractor's option, raceways installed underground or below slabs on grade, may be Schedule 40 heavy wall rigid PVC conduit. Such raceways which carry electrical circuits shall be provided with separate ground wires

as required by NEC Article 250 and 346. All elbows that turn up from below grade to above grade or above slab shall be rigid galvanized steel.

3. Where National and local codes prohibit use of electrical metallic tubing or rigid non-metallic conduit (Schedule 40 PVC), rigid hot-dipped galvanized steel conduit shall be used.

F Sizes:

1. Unless otherwise indicated, all conduits shall be 1/2" trade diameter, minimum. Larger sizes shall be used where indicated or where required due to conductor quantity.
2. Conduit concealed in slabs shall not exceed 1-1/4" nor be less than 3/4".
3. No bends shall be made with a radius less than six (6) times the diameter of the conduit nor more than 90°.

G SUPPORTING DEVICE INSTALLATION

1. Spacing and Attachment: Support exposed or concealed conduit from walls or ceilings, at intervals required by Code but not to exceed intervals of 5'-0" for electrical metallic tubing and 10'-0" for rigid steel conduit, with approved galvanized iron clamps or hangers. Devices attached to masonry or slabs shall be secured with inserts or bolts or lead expansion sleeves. Where two or more conduits run adjacent, they shall be installed on gang hangers.
2. Cable Clamps: Provide cable clamps in vertical conduit riser at intervals prescribed by the National Electric Code.
3. Limitations: Wire, pipe straps, nails, ceiling construction or other means shall not be used for supporting conduit runs, exposed or in suspended ceilings, nor shall they be strapped to other piping.

3.02 CONDUIT AND RACEWAY INSTALLATION

A Larger Sizes: The conduit sizes indicated on the drawings may be increased, if required, to facilitate the pulling of cables.

B Accessories: Provide junction boxes or pull boxes where shown on the drawings and where necessary to avoid excessive runs or too many bends between outlets. Where raceways are routed concealed in above grade concrete or masonry construction, pull boxes shall be provided if the total number of bends exceeds 180° or the length of run exceeds 100 feet. Additional pull boxes shall be provided as necessary to facilitate installation of cables or conductors. All such pull boxes shall be accessible after completion.

C Grouting: Grout around all conduits passing through walls, except where fire stops are used.

D Fire Stops: Provide fire stops wherever conduits pass through fire rated walls (elevator shaft and stairwells) or floor slabs. Install in strict accordance with manufacturer's instructions.

E Empty Raceways: Provide empty raceways where indicated on the drawings. An insulated plastic pull wire shall be pulled into each empty raceway and left for future use.

F Raceways run underground shall be a minimum of 36 inches below grade or paving.

G Where raceways are run below grade and in parallel configuration (e.g. service entrance or feeders exceeding 400 amps), such raceways shall be racked on conduit spacers manufactured for this purpose. Spacers shall be located at maximum spacing of 5'-0" along conduit run. Spacers shall be constructed so that conduits maintain a separation of 7.5 inches center to center.

END OF SECTION 260533

SECTION 260534 - OUTLET BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A Description of System: Standard galvanized steel boxes shall be provided at all outlets for lights, switches, receptacles, etc., except as specified herein.

1.02 QUALITY ASSURANCE

A Acceptable Manufacturers: Outlet boxes shall be Midland-Ross, Appleton, Raco, National Electric Products Company or Steel City Electric Company.

1.03 JOB CONDITIONS

A Protection: Anchor boxes securely to formwork. Provide necessary protection to prevent entry of concrete.

B Sequencing, Scheduling: Locations of outlets shown on the drawings are relative and approximate. Exact locations shall be determined on the job and the outlets accurately set according to the Architectural drawings, dimensions, building conditions and Architect's direction. The right is reserved to change the exact location of any switch, ceiling outlet or other outlet in any room before it is permanently installed.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A Standard Outlet Boxes: Boxes and covers shall be galvanized steel, not less than 1/16" thick and, in every instance, of such form and dimensions as to be adapted to its specific use and location, kind of fixtures to be used and number, size and arrangement of conduits or cables connecting thereto.

B Ceiling outlet boxes shall be 1-1/2 or 2-1/8 inches deep, 4 inches octagonal or 4 inches square when required due to number of wires. Plaster rings or device covers need not be provided on ceiling boxes.

C Wall outlet boxes for toggle switches and convenience outlets shall be 1-1/2 or 2-1/8 inches deep, 4 inches square. Provide with single device plaster rings (or two-device plaster rings where needed). Plaster rings shall be raised type to compensate for thickness of plaster or gypsum board wall finish. All outlet boxes shall be set to within 1/8" of finished wall surface.

D Junction boxes shall be as specified for ceiling and wall outlet boxes. Provide flat steel covers on ceiling outlets painted to match surrounding ceilings. Provide blank device-type cover plates on wall outlets, of same materials and exact color as specified for device plates in same room or area.

E Outlet boxes for exposed conduit exposed to weather or dampness shall be cast ferrous alloy, galvanized.

F Covers: Where outlet boxes are to be capped, blank cover plates shall be used.

G Outlet boxes for use in masonry walls shall be not less than 1/16" steel with square corners, minimum 4" square x 2-1/2" deep, designed to be used in masonry walls.

PART 3 EXECUTION

3.01 INSPECTION

A The location of all wall outlets, including light fixtures, receptacles switches, etc., shall be verified to see that the outlet will clear any wall fixture, shelving, work tables, sinks, baseboard and fin type convectors, bulletin boards, etc., before they are installed.

B Coordination: Exact locations of outlet boxes shall be coordinated with other trades, so that outlet will not be covered by ductwork, piping, etc.

C The approximate locations of outlets are indicated on the drawings. The exact locations shall be determined during construction. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10 feet before it is permanently installed.

3.02 PREPARATION

A Architectural Placement: Outlets occurring in architectural features shall be accurately centered in same. Space wall switch outlets equi-distant from door trims on the strike side of doors as actually installed.

1. Mounting Height:
2. Unless otherwise required, indicated or directed, outlet boxes shall be placed with center lines at the following distances above the finished floor:

a.	Wall Switches	48"
b.	Wall Convenience	18"
c.	Outlets	18"
d.	Wall Telephone	18"
e.	Outlets	18"
f.	Thermostats	60"
g.	Special Outlets	As noted on the drawings.
h.	Exit Signs (Wall)	12" above door header

i. Install all outlet boxes in finished areas flush with wall or ceiling finish.

j. All outlet boxes for switches at same level shall be installed with each center line on one horizontal line as shown on drawings.

k. Wall mounted controls, including temperature controls, in a room shall be grouped at the same location and at same mounting heights.

3.03 INSTALLATION

A At all concealed outlets for lighting fixtures, wall switches, wall receptacles, etc., installed in gypsum board construction, standard galvanized steel outlet boxes shall be provided. Provide plaster rings where required.

B Outlet boxes shall be firmly anchored in place and shall be provided with approved fixture studs where required.

C Outlet boxes installed in masonry construction shall be set plumb and flush with finished wall on all sides. Openings for boxes shall be cut to the same outside dimensions as the box or shall be finished with grout flush to the edges of the box.

D The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the cover plate is installed and the cover plate shall not be used as a means of tightening the devices in place. The openings for each box shall be cut or finished so that the supporting ears for each device will be completely supported on top and bottom by

the wall surface.

END OF SECTION 260534

SECTION 262200

DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 GENERAL

1.01 SUMMARY

A This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

(1) Distribution transformers.

(2) Buck-boost transformers.

(3) Control and signal transformers.

1.02 SUBMITTALS

A Product Data: For each product indicated.

B Shop Drawings: Wiring and connection diagrams.

C Output Settings Reports: Record of tap adjustments specified in Part 3.

1.03 QUALITY ASSURANCE

A Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B Comply with IEEE C 57.12.91.

C Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.04 DELIVERY, STORAGE, AND HANDLING

A Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

(1) Acme Electric Corporation; Power Distribution Products Division.

(2) Challenger Electrical Equipment Corp.; a division of Eaton Corp.

(3) Computer Power Inc.

(4) Controlled Power Co.

(5) Cutler-Hammer.

(6) Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.

(7) ABB - GE Electric.

(8) Hammond Co.; Matra Electric, Inc.

(9) MagneTek.

(10) Micron Industries Corp.

(11) Siemens Energy & Automation, Inc.

(12) Sola/Hevi-Duty Electric.

(13) Square D/Groupe Schneider NA.

2.02 MATERIALS

A Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B Cores: Grain-oriented, non-aging silicon steel.

C Coils: Continuous windings without splices, except for taps.

(1) Internal Coil Connections: Brazed or pressure type.

(2) Coil Material: Copper.

2.03 DISTRIBUTION TRANSFORMERS

A Comply with NEMA ST 20, and list and label as complying with UL 1561.

B Provide transformers that are internally braced to withstand seismic forces for this area of the country.

C Cores: One leg per phase.

D Enclosure: Ventilated, NEMA 250, Type 2.

(1) Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E Finish: Comply with NEMA 250 for Indoor Corrosion Protection."

F Finish Color: Gray

G Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

H Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

I Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

J Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

K K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.

L Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.

M Indicate value of K-factor on transformer nameplate.

N Wall Brackets: Manufacturer's standard brackets.

O U.S. Department of Energy 10 CFR Part 431 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, dated April 18, 2013. These efficiency standards shall take effect January 1, 2016. All transformers covered in the scope of this document and this specification, manufactured after December 31, 2015, shall be compliant with the new standard.

2.04 SOURCE QUALITY CONTROL

A Test and inspect transformers according to IEEE C57.12.91.

PART 3 EXECUTION

3.01 INSTALLATION

A Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B Install floor-mounting transformers level on concrete bases. Construct concrete bases not less than 4 inches larger in both directions than supported unit and 4 inches high.

3.02 CONNECTIONS

A Ground equipment according to Division 16 Section "Grounding and Bonding."

B Connect wiring according to Division 16 Section "Conductors and Cables."

3.03 ADJUSTING

A Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C Output Settings Report: Prepare a written report recording output voltages and tap settings.

END

SECTION 262416 - BRANCH CIRCUIT PANELBOARDS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide the branch circuit panelboards and power distribution panelboards indicated on the drawings, complete with all circuit breakers and spaces as scheduled on the drawings.

1.02 QUALITY ASSURANCE

A. Branch circuit panelboards and power distribution panelboards and the branch circuit breakers enclosed therein shall be General Electric, Square D, Siemens or Westinghouse.

B. Panelboards shall be factory assembled.

1.03 SUBMITTALS

A. Shop drawings shall clearly indicate enclosure size, gutter space, breaker frame sizes and trips, and main bus type and rating.

PART 2 PRODUCTS

2.01 BRANCH CIRCUIT PANELBOARDS

A. Panelboards shall be of the automatic circuit breaker type, three-phase, four-wire, solid neutral with main lugs sized for each respective feeder and main bus of 98% conductivity silver plated copper equal to or greater in capacity than the rating of the overcurrent device serving each respective panel. Panelboards shall bear UL labels.

B. Panelboards shall be flush or surface mounted, as scheduled, having a minimum width can of 20", with baked-on enamel trim, adjustable trim clamps and door with chromium plated combination cylinder lock and catch. Provide a typewritten directory, under plastic, with all spares marked in pencil.

C. The neutral bus shall utilize set-screw to bond the neutral wire to the neutral bus through holes drilled in the neutral bar.

D. All circuit breakers shall be UL labeled and shall be thermal and magnetic molded cast type, quick-make and quick-break both on manual and on magnetic operation, and shall be bolted to the panel bus. Breakers shall be of the over-the-center toggle operating type, with the handle going to a position between "ON" and "OFF" to indicate automatic tripping. All multi-pole breakers shall be internal common trip. Breakers shall not be rated at less than 10,000 RMS symmetrical amperes.

E. All molded case main circuit breakers shall be vertically mounted with the handle up for "ON" and down for "OFF" and shall be UL approved for feeding in the bottom and out the top.

F. Each panelboard, as a complete unit, shall have a rating equal to or greater than the integrated rating shown on the panelboard schedule on the plans. Such ratings shall be established by tests with the circuit breakers mounted on the panelboard. The short circuit test on the circuit breaker and on the panelboard structure shall be made simultaneously by connecting the fault to each panelboard breaker with the panelboard connected to its rated voltage source.

G. Shop drawings for the panel shall show that all of the aforementioned requirements have been incorporated into each panel. Panels shall be Square D, General Electric, Westinghouse or Siemens. The branch circuit breaker arrangement in each respective panel shall be as scheduled on the plans.

H. Cabinets shall be of code gauge steel with overlapped riveted or welded corners

and with edges turned to receive trim. Each trim shall be of the same size as that of its cabinet or one and one half inches (1-1/2") oversize, according to whether the cabinet required is surface-mounted or flush-mounted. Trim shall be held in place by hidden trim clamps or other adjustable fasteners which will permit adjustment. Doors shall be provided with latches, locks and keys.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide branch circuit and power distribution panelboards where indicated and as scheduled on the drawings.

B. Unless otherwise indicated on the drawings, provide from each flush mounted panel four (4) 3/4" empty conduits stubbed out into ceiling space and capped.

C. Top of panel trim shall, in general, be at the same height above the floor throughout the building.

D. No breaker handle shall be higher than 6'-0" above the floor.

E. Fasten cabinets securely to wall or structure. Flush cabinets shall have trim which covers wall openings; set cabinets so that trim will fit smooth and flush all around cabinets.

F. All conductors within the cabinets of power distribution and branch circuit panelboards shall be neatly laced together with plastic cable clamps, nylon banding or other approved means, and shall be of such length to allow ease of bending, (in small sizes, bends shall be "square"), neat and strain-free connections.

G. Each and every branch circuit in all panelboards shall have typewritten identification with complete description of load served on index card.

H. The designation of each panelboard (PANEL LA, etc.) shall be engraved on a laminated black /white plastic plate in 1/2 inch high letters and affixed to the panelboard front. On the same plate, below the designation, engrave in 1/4 inch letters the panel voltage. Nameplate shall be fastened to panelboard with sheet metal screws.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A Description of System: Provide wiring devices complete with all required accessories as indicated on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A Acceptable Manufacturers: Wiring devices and cover plates shall be Arrow-Hart, Bryant, General Electric, Hubbell, Leviton or Sierra.

B Wiring devices shall comply with applicable sections of NEMA Standard WD-1.

C All special purpose receptacles shall be NEMA standard configuration.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A Wall switches shall be flush, specification grade, totally enclosed, self-grounding type, designed for quiet operation. Switches shall be rated 20 amperes, for operation at 120/277 volts and shall be of type as follows:

1. Single Pole: Hubbell #1221
2. Double Pole: Hubbell #1222
3. Three-Way: Hubbell #1223
4. Four-Way: Hubbell #1224

B Color shall be ivory, gray, beige, white, red, black or brown as selected by the Architect. Comparative switches by Leviton, Arrow-Hart, Eagle or Pass & Seymour are acceptable as equal.

C Switches utilized as local equipment or motor disconnect switch shall be as specified in SECTION 16170 "DISCONNECTS".

D Wall occupancy sensors for room lighting control shall have an override switch

2.02 RECEPTACLES

A Receptacles shall be specification grade, straight blade or locking, grounding type, of ampere and voltage rating and NEMA configuration as indicated on the Drawings. Receptacles shall be manufactured by Hubbell, Eagle, Arrow-Hart, Leviton or Pass & Seymour, per the following Hubbell Catalog Numbers:

Device Type	Volts, Phase, Amps	Hubbell #
NEMA 5-15R Duplex	120V, 1 Phase, 15A	5262
NEMA 5-15R Single	120V, 1 Phase, 15A	5261
NEMA 5-20R Duplex	120V, 1 Phase, 20A	5362
NEMA 5-20R Single	120V, 1 Phase, 20A	5361
NEMA 5-15R GFI Duplex	120V, 1 Phase, 15A	GF-5262
NEMA 5-15R IG Duplex	120V, 1 Phase, 15A	IG-5262
NEMA 6-20R (Single)	208V, 1 Phase, 20A	5461

B Other convenience outlets of different configuration or rating are indicated by special symbol and notes on the drawings.

C Color shall be ivory, gray, beige, white, black or brown as selected by the Architect. Receptacles indicated to be served from panels B, E,S,U shall be red.

D Comparative receptacles by Leviton, Arrow-Hart, Eagle or Pass & Seymour are acceptable as equal.

2.03 DEVICE COVER PLATES

A Cover plates for flush-mounted devices shall be plastic, smooth surface, mid-way size. Color shall be ivory, gray, beige, white, red, black or brown as selected by the

Architect.

B Cover plates shall be manufactured by Hubbell, Arrow-Hart, Leviton or Pass & Seymour.

C Telephone outlet cover plates shall have an RJ-45 jack connected to cable.

D Where more than one device is indicated at a location, the devices shall be mounted in combined sectional gang boxes and covered jointly by a common plate.

E Cover plates for surface mounted devices shall be formed steel with cadmium plating.

F Weatherproof receptacles shall be equipped with double-life gasketed weatherproof plate, Arrow-Hart #4500, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A Cover Plates: Cover plates shall be provided for all devices, including wall switches, wall telephone outlets and receptacles. Where more than one flush device occurs at the same location, arrange in gangs, under one cover plate.

B Wall Receptacles: Provide an 8" long flexible pig-tail green ground wire from grounding lug of all grounding type receptacles to a suitable bonding device on the conduit or the outlet box. Ground wire shall not be connected to screw which attaches receptacle to outlet box.

C For all device types other than NEMA 5-15R, 5-20R and 6-20R provide a matching cord and plug for each receptacle installed. Deliver such plugs to the Owner at completion of construction.

D All devices installed in outlet boxes shall be screwed tight to the box before the cover plate is installed. Cover plate shall not be used as a means of tightening the device in place.

END OF SECTION 262726

SECTION 262817 - DISCONNECT SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A Provide disconnect devices complete with all required accessories as indicated on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A Acceptable Manufacturers:

1. Safety Switches: General Electric.
2. Individually Enclosed Circuit Breakers: General Electric.

PART 2 PRODUCTS

2.01 SAFETY SWITCHES

A Safety switches shall be heavy duty, horsepower rated, fusible or non-fusible as indicated or noted on the drawings. They shall be of ampere rating and number of poles as noted on the drawings and of voltage rating as required for the voltage of the circuit in which used.

B For small loads -- not larger than one horsepower or 15 amperes -- disconnect switches shall be toggle devices with thermal overloads equal to Square-D Class 2510, SPST or DPST as required.

C Enclosure shall be NEMA 1 for indoor locations and NEMA-3R for outdoor locations, unless otherwise noted. Covers shall be interlocked to prevent opening, unless switch is in "OFF" position.

D Switches shall have a factory applied gray enamel finish.

2.02 FUSES

A Fuses shall be dual-element, Class RK1, Bussmann "Limitron" for 600 amperes and below and Class "L" Bussmann "Hi-Cap" for 601 amperes and above.

B In control circuits and in specialized equipment, protective fusing shall be as required by the systems or equipment supplier.

PART 3 EXECUTION

3.01 INSPECTION

A Verify the nameplate data of equipment to be served with the information shown on the drawings.

3.02 INSTALLATION

A Mounting: The circuit breakers and safety switches shall be installed on walls, power backboards, plenums, etc., as indicated by the drawings. Unless otherwise noted, they shall be installed 5'-0" above finished floor to top of enclosure.

B Fuses: Provide fuses for all new fusible equipment furnished under this Division of the Specifications.

END OF SECTION 262817

SECTION 263213

PACKAGED ENGINE GENERATORS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes packaged diesel-engine generator sets with the following accessory features.
   1. Battery charger.
   2. Base mounted state double wall tank (168 hours of run time).
   3. Muffler.
   4. Outdoor enclosure.
   5. Remote annunciator.
   6. Remote stop switch.
   7. Starting battery.

B. See Division 26 Section 26415 "Transfer Switches" for transfer switches, containing sensors and relays to initiate automatic starting and stopping.

C. The generator fuel tank must comply with all EPA standards (with Georgia Amendments) regarding fill requirements, fill shut-off and alarms, and containment. Must meet NFPA 110 (2002 Edition) with Georgia Amendments. Must have an alarm, when fueling tank, that alarms when tank is 90% full and a positive cut-off when tank is 95% full.

1.02 SUBMITTALS

A. Product Data: For the generator set and each accessory component indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Certified prototype test reports.

D. Field quality-control test reports.

E. Operation and maintenance data. Final instructions about general maintenance and care of the generator set, and fuel tank shall be video taped and turned over to the owner.

F. The contractor shall provide eight (8) hours of general instructions, which shall be video taped, on the operation, care, and period maintenance on the emergency generator.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with twenty four hours' maximum response time.

B. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with NFPA 110 requirements for emergency power supply system.

F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling air intake and discharge, and other components of the installation.

G The manufacturer shall provide a written proposal to the owner, with the close out documents, the cost of a full load test on the generator set on an annual basis.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Generac Corp.
2. Kohler Co; Generator Division.
3. Onan Corp; Industrial Business Group.

2.02 ENGINE GENERATOR SET

A Provide a coordinated assembly of compatible components.

B Safety Standard: Comply with ASME B15.1.

C Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.

2.03 GENERATOR-SET PERFORMANCE

A Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.

B Steady-State Voltage Modulation Frequency: Less than 1 Hz.

C Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.

D Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

E Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.

F Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.

G Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.

H Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the generator and its protective devices will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

I Start Time: Comply with NFPA 110, Type 10, system requirements.

J Environmental Conditions: Engine generator shall be equipped to start and operate satisfactorily under the following environmental conditions without mechanical or electrical damage or deg radation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Ambient Temperature: Minus 15 to plus 40 deg C.
3. Relative Humidity: 0 to 95 percent.
4. Altitude: Sea level to 1000 feet.

2.04 ENGINE

A Description: 4-cycle unit with maximum piston speed of 2250 fpm.

B Comply with NFPA 37.

C Fuel: Fuel oil, Grade DF-2.

D Rated Engine Speed: 1800 rpm.

E Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

F Engine Fuel System: Comply with NFPA 37. System includes the following:

G Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

1. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

H Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.

2.05 GOVERNOR

A Type: Adjustable isochronous, with speed sensing.

2.06 ENGINE COOLING SYSTEM

A Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.

1. Radiator Core Tubes: Nonferrous-metal construction other than aluminum.

2.07 FUEL SUPPLY SYSTEM

A Comply with NFPA 30 and NFPA 37.

B Comply with UL 142; listed, freestanding, factory-fabricated assembly of a fuel tank with integral, float-controlled transfer pump and the following features:

1. Leak Detector: Locate in interstitial space and connect to provide audible and visual alarm in the event of leak.
2. Tank Capacity: 400 gallons (Contractor provide 50 gallons for testing).
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Operates alarm contacts at 75 percent of normal fuel level.
5. High-Level Alarm Sensor: Separate device operates alarm and redundant fuel shutoff contacts at 106 percent of normal fuel level.
6. Piping Connections: Include fuel suction and return lines to fuel storage tank; fuel supply; and return lines to engine, local fuel fill, vent line, overflow line, and tank drain line complete with shutoff valve.

C Base-Mounted Double Wall Fuel Oil Tank: Factory-installed and -piped, listed unit. Features include the following:

D Tank level indicator and remote tank level inside building.

E Tank to be extended longer than generator enclosure to allow exterior vents and fill.

1. Vandal-resistant fill cap with 5 gallon spill bucket.

F Containment Provisions: Comply with requirements of authorities having jurisdiction.

G Exterior Fuel Oil Piping and Remote Fuel Oil Storage Tank: As specified in Division 2 Section "Fuel-Oil Distribution."

H Interior Fuel Oil Piping: As specified in Division 15 Section "Fuel Oil Piping."

2.08 ENGINE EXHAUST SYSTEM

A Muffler: Critical type, sized as recommended by engine manufacturer. Measured sound level at a distance of 10 feet from exhaust discharge, is 85 dBA or less.

B Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.

C Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.

D Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.

E Insulation for Mufflers and Indoor Exhaust Piping: As specified in Division 15 Section "Pipe Insulation."

F Supports for Muffler and Exhaust Piping: Spring hangers and all-thread rods and vibration hangers as specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

G Exhaust Piping External to Engine: ASTM A 53, Schedule 40, welded, black steel, with welded joints and fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation and joint construction. Refer to Division 15 Section "Hydronic Piping" for materials and installation requirements for exhaust piping.

2.09 COMBUSTION-AIR-INTAKE

A Description: Standard-duty, engine-mounted air cleaner with replaceable dry filter element and "blocked filter" indicator.

2.10 STARTING SYSTEM

A Description: 24-V electric, with negative ground and including the following items:

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 60 seconds.

B Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.

C Battery Cable: Size as recommended by generator-set manufacturer for cable length and battery capacity indicated. Include interconnecting conductors and connection accessories.

D Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

1. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
2. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
3. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
4. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.

5. Ammeter and Voltmeter: Flush mounted in door. Ammeter indicates charging rate.
6. Safety Functions: Include sensing of abnormally low battery voltage, arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either of latter conditions closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
7. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.11 CONTROL AND MONITORING

A Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

B Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.

C Indicating and Protective Devices and Controls: Include those required by NFPA 110 for a Level 1 system, and the following:

D Indicating and Protective Devices and Controls: Include those required by NFPA 110 for a Level 2 system, and the following:

E Indicating and Protective Devices and Controls: Include the following:
1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator voltage adjusting rheostat. Start-stop switch.
10. Overspeed shutdown device.
11. Coolant high-temperature shutdown device.
12. Coolant low-level shutdown device.
13. Oil low-pressure shutdown device.

F Fuel tank derangement alarm.

G Fuel tank high-level shutdown of fuel supply alarm.

H Low battery alarm.

I Battery charger malfunction alarm.

J Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

K Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Locate audible device and silencing means where indicated.

L Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Locate audible device and

silencing means where indicated. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine high-temperature shutdown.
2. Lube-oil low-pressure shutdown.
3. Overspeed shutdown.
4. Remote emergency-stop shutdown.
5. Engine high-temperature prealarm.
6. Lube-oil low-pressure prealarm.
7. Fuel tank low level.
8. Overcrank shutdown.
9. Coolant low-temperature alarm.
10. Control switch not in auto position.
11. Battery-charger malfunction alarm.
12. Battery low-voltage alarm.
13. Fuel tank level

M Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.

2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

A Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B Generator Protector: Microprocessor-based unit that continuously monitors current level in each phase of generator output, integrates generator heating effect over time, and predicts when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.
3. As heating effect on the generator of overcurrent approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect switch, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.13 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A Comply with NEMA MG 1 and specified performance requirements.

B Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.

C Electrical Insulation: Class H or F.

D Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during specified intervals of operation at 110 percent of rated capacity.

F Exciter uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.

G Enclosure: Drip proof.

H Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output- voltage operating band.

I Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.14 OUTDOOR GENERATOR-SET ENCLOSURE

A Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple housing-access panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments and controls are mounted within enclosure.

B Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in "Service Conditions" Article.

C Louvers: Fixed-engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.

D Convenience Outlet: Factory wired. Arrange for external circuit supply.

2.15 FINISHES

A Description: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.16 SOURCE QUALITY CONTROL

A Factory Tests: Include prototype testing and Project-specific equipment testing (testing of equipment manufactured specifically for this Project).

B Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with those required for Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.

C Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Perform tests at rated load and power factor. Include the following tests:

1. Full load run.
2. Maximum power.
3. Voltage regulation.
4. Transient and steady-state governing.
5. Single-step load pickup.
6. Safety shutdown.

PART 3 EXECUTION

3.01 INSTALLATION

A Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with NFPA 110.

B Set packaged engine generator on concrete base. Cast-in-place concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

C Support generator-set mounting feet on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide 3/4- to 1-1/2-inch gap between pump base and foundation for grouting.
D Adjust metal supports or wedges until generator is level.
E Install packaged engine generator to provide access for periodic maintenance without removing connections or accessories.
F Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Size piping according to manufacturer's written instructions.
G Install condensate drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system and from muffler to condensate traps and to point of disposition.
H Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.02 IDENTIFICATION
A Identify system components according to Division 15 Section "Mechanical Identification" and Division 16 Section "Electrical Identification."

3.03 FIELD QUALITY CONTROL
A Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to supervise testing. Report results in writing.
B Tests: Include the following:
1. Tests recommended by manufacturer.
2. InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
4. Single-step full-load pickup test.
5. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
6. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
7. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator installation before and during system operation. Check for air, exhaust, and fluid leaks.
8. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
C Coordinate generator-set tests with tests for transfer switches and perform them concurrently.
D Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

E Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

F Test instruments shall have been calibrated within the last 12 months, traceable to NIST standards, and adequate for making positive observation of test results. Make calibration records available for examination on request.

3.04 BATTERY EQUALIZATION

A Description: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

3.05 DEMONSTRATION

A Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 1 Section "Closeout Procedures".

1. Coordinate with training requirements for transfer switch.

End

SECTION 263600 - TRANSFER SWITCH

PART 1 GENERAL

1.01 SUMMARY
- A This Section includes automatic transfer switches rated 600 V and less.
- B See drawings for ampere rating of transfer switch.

1.02 SUBMITTALS
- A Product Data: For each type and rating of transfer switch indicated.
- B Shop Drawings: Include plans, elevations, sections, details of installation, minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists.
  1. Wiring Diagrams: Power, signal, and control wiring.
- C Field quality-control test reports.
- D Operation and maintenance data.
- E The contractor shall provide four (4) hours of general instructions, which shall be video taped, on the operation, care, and period maintenance on the transfer switch.

1.03 QUALITY ASSURANCE
- A Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
- B Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C Comply with NEMA ICS 1.
- D Comply with NFPA 70.
- E Comply with NFPA 99.
- F Comply with NFPA 110.
- G Comply with UL 1008, unless requirements of these Specifications are stricter.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Transfer Switches without Molded-Case Devices:
     a. Emerson Electric Co.; Automatic Switch Co. Subsidiary.
     b. Generac Corp.
     c. Kohler Co.
     d. Onan Corp.; Electrical Products Division.
     e. Russelectric, Inc.
     f. Spectrum Detroit Diesel.
     g. Zenith Controls, Inc.
  2. Transfer Switches Using Molded-Case Switches or Circuit Breakers:
     a. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
     b. Hubbell Industrial Controls, Inc.
     c. Lake Shore Electric Corp.
     d. Zenith Controls, Inc.

2.02 TRANSFER-SWITCH CHARACTERISTICS AND FEATURES

A Acceptable Components: Automatic transfer switches may use molded-case switch or circuit breaker components for main switching devices. Switch shall be 3 pole.

1. Switches shall be designed for continuous-duty repetitive transfer of full-rated current between active power sources.
2. Switch Action: Double throw; mechanically held in both directions; incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
3. Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

B NFPA 110 Compliance: Comply with Level 1 equipment requirements.

C Controls: Solid-State; repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41, Category B. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E Neutral Terminal: Solid and fully rated, unless otherwise indicated.

F Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

G Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

H Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

I Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

J Signal-before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

K Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

L Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

M Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

N Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes; factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

O Test Switch: Simulates normal-source failure.

P Switch-Position Pilot Lights: Indicate source to which load is connected.

Q Source-Available Indicating Lights: Supervise sources via transfer-switch, normal- and emergency-source sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

R Unassigned Auxiliary Contacts: Two normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

S Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

T Engine Starting Contacts: One isolated, normally closed and one isolated, normally open, rated 10 A at 32-V dc minimum.

U Engine Shutdown Contacts: Instantaneous. Initiates shutdown sequence at remote engine-generator controls after retransfer of load to normal source.

V Engine Shutdown Contacts: Time delay adjustable from zero to five minutes; factory set for five minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.

W Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

1. Exerciser Transfer Selector Switch: Selects exercise with and without transfer.
2. Control: Push-button programming with digital display of settings and integral battery operation when normal control power is not available.

2.03 TRANSFER-SWITCH RATINGS

A Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B Tested Fault-Current Closing and Withstand Ratings: Adequate for indicated available fault conditions without damage to unit components, based on testing according to UL 1008.

2.04 FINISHES

A Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.05 SOURCE QUALITY CONTROL

A Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 EXECUTION

3.01 APPLICATION

A Four-Pole Switches: Connect fourth pole to switch the neutral.

3.02 INSTALLATION

A Wall-Mounted Switches: Mount plumb and rigid without distortion of enclosure.

B Floor-Mounted Switch: Level and anchor unit to floor.

C Identify components according to Division 16 Section Basic Electrical Materials and Methods.

3.03 FIELD QUALITY CONTROL

A Testing: Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.

1. Before energizing equipment, after transfer-switch products have been installed, do the following:
   a. Measure insulation resistance phase-to phase and phase-to-ground with insulation-resistance tester. Include external control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
   b. Check for electrical continuity of circuits and for short circuits.
   c. Inspect for physical damage; proper installation and connection; and integrity of barriers, covers, and safety features.
   d. Verify that manual transfer warnings are properly placed.
   e. Perform manual transfer operation.
2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by inspection of control settings.
   e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
   f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown sequence.

B Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

1. Assist in verifying grounding connections and locations and ratings of sensors.
2. Assist in observing reaction of circuit-interrupting devices when simulated fault current is applied at sensors.

C Coordinate tests with tests of generator plant and run them concurrently.

D Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.04 DEMONSTRATION

A Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches. Refer to Division 1 Section "Closeout Procedures."

ENE OF SECTION 263600

SECTION 264113 - LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this section of the specifications consists of furnishing all design, materials, labor and items of service required for the completion of a functional lightning protection system as approved by the Architect/Engineer, and in strict accordance with this section of the specifications and the applicable contract drawings.

B. If any departure from the contract drawings of submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practicable to the architect for approval. No such departures shall be made without the prior written approval of the Architect.

C. The following specifications and standards of the latest issue form a part of this specification:

1. Underwriters Laboratories UL96, 96A (2001 Edition)
2. National Fire Protection Code NFPA 780 (1995 Edition)
3. Lightning Protection Institute (LPI-175) (1987 Edition)

D. Do not drill into roof for any installation.

1.02 QUALITY ASSURANCE

A. The lightning protection system shall conform to the requirements of the U.L. and NFPA Standards for Lightning Protection Systems.

B. The system to be furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design. The equipment manufacturer shall also be U.L. listed and approved manufacturer and a fully certified manufacturer member in good standing of the Lightning Protection Institute. All materials specified for this work shall be supplied by VFC, Inc., Harger Lightning Protection, Inc. or approved equal. For approval of LPI manufacturer other than specified, proposed material data and installation drawings must be submitted for review not less than 10 days prior to bid.

1.03 SUBMITTALS

A. Complete shop drawings showing the type, size, and locations for all equipment, grounds, and cable routings, etc., shall be submitted to the architect for approval prior to start of work.

B. Samples and pertinent catalog data shall be submitted to the architect for approval.

PART 2 PRODUCTS

2.01 STANDARDS

A. All equipment used in this installation shall be factory inspected approval and properly labeled in accordance with U.L. requirements.

B. All equipment shall be new, the product of a single manufacturer as outlines above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and U.L. and NFPA Code requirements for Class I structures and as per manufacturer recommendations.

2.02 EQUIPMENT

A. All materials shall be copper or copper alloy and of the size, weight, and construction to suit the application where used in accordance with U.L. and

NFPA Code requirements for Class I structures and as per manufacturer recommendations.

B. Conductors shall be copper, of 32 strands 16 gauge minimum, VFC Catalog.
C. No. 32 or as specified in contract drawings.
D. Air terminals shall be solid, round copper bar of a minimum of 3/8” □x 12”.
E. VFC Catalog No. 3812CUAT, and shall project 10□□minimum above the object to be protected. Locate and space according to UL and NFPA requirements. Use aluminum points of ½” x 12”, VFC Catalog No. 1212ALAT, only when required for corrosion prevention.
F. Air terminal bases shall be of cast bronze with bolt pressure cable connections and shall be securely mounted with stainless steel screws or bolts. Crimp type connectors are not acceptable. VFC Catalog No. CUBU38I, CUBS38, etc. as required.
G. Ground rods shall be a minimum 5/8” in diameter and 10’-0” long. VFC
H. They shall be connected to the system by exothermic weld.
I. Cable fasteners shall be substantial in construction, electrolytically compatible with conductors and mounting surface and shall be spaced according to LPI and NFPA Code requirements. When using adhesive supports, adhesive must be compatible with roof material, and shall be approved by roofing manufacturer prior to installation.
J. Bonding devices, cable splicers and miscellaneous connectors shall be by exothermic weld or of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable.
K. Equipment on stacks and chimneys shall be protected from corrosion and sized in accordance with U.L. and NFPA requirements.
L. All miscellaneous bolts, nuts and screws shall be brass, bronze, or stainless steel.

PART 3 INSTALLATION

3.01 INSTALLATION

A. The installation shall be accomplished by an experienced installer who has at least 5 years of experience in this work.
B. Certified Master installer of the LPI or working under the direct supervision of an LPI manufacturer as listed above or his authorized LPI Certified Master Installer representative.
C. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof involving all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction or in conduit to ground.
D. Downlead cables shall be brought down concealed within exterior walls of the structure.
E. Copper equipment shall not be connected to aluminum surfaces except by means of an U.L. approved bimetal transition fitting.

3.02 COORDINATION

A. The lightning protection installer will work with other trades in insure a correct, neat and unobtrusive installation.
B. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other building ground systems, including both telephone and electrical. Proper arresters shall be installed on the power and telephone service by either the utility or the electrical contractor as applicable.

3.03 COMPLETION

A. The lightning protection installer shall secure and deliver the U.L. Master.
B. Label “C” to the architect for the owner upon completion of the installation.
C. The Contractor shall also submit copies of as-built shop drawings.

END OF SECTION 264113

SECTION 265100 - LIGHTING

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies the lighting system requirements.

B. All fixtures shall be properly installed, completely wired, connected to current source, provided with lamps, ready to use.

C. Where indicated on the drawings, certain lighting circuits shall be controlled by time switches for automatic operation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to another Division for the ceiling systems.

B. The lighting system shall be coordinated with ceiling systems and other architectural finishes in which the fixtures are installed or to which they are attached. The Contractor shall obtain all appropriate architectural plans and details to insure that all trims and mounting hardware are completely compatible with each application.

PART 2 PRODUCTS

2.01 LIGHTING FIXTURES

A. The general specifications for each lighting fixture type are as indicated on the lighting fixture schedule. Where a manufacturer's name and catalog number are indicated, the manufacturer's specification for that product is incorporated herein by reference.

B. Each fixture shall be furnished with all required trim and mounting hardware required to install the fixture in, on or suspended from, the ceiling or other architectural finish.

C. Suspended fixtures shall be furnished with pendants or cables specifically designed for each application. Stem or cable canopies shall be furnished to fit flush with the ceiling or wall finish regardless of attaching method.

D. Fluorescent troffer type fixtures shall have a post-fabrication applied white enamel finish with a minimum reflectance of 86%. Lenses shall be as indicated in the lighting fixture schedule, some are special.

E. Surface mounted fluorescent strips or industrial fixtures shall be provided with 1-1/2" offset mounting brackets. Provide a minimum of two for each fixture and not less than two per 4 feet of length for continuous rows or for fixtures longer than 4 feet.

2.02 BALLASTS

A. All electromagnetic fluorescent lamp ballasts shall be low-loss, high power factor, Class "P", with "A" sound rating and shall bear UL and CBM certifications. Ballasts shall be Valmont "Maxi-Miser I," Advance "Mark III" or Universal "SLH".

B. Electronic ballasts shall be solid state, full light output, Class "P" and shall bear U.L. certification. Ballasts shall be Universal "Triad", or equal by Advance, Thomas Industries or Valmont.

C. Ballasts for compact fluorescent (PL or Biax) lamps shall be high power factor.

D. Ballasts for fluorescent fixtures installed in unheated spaces or for exterior applications, shall be low temperature start, rated 0°F.

2.03 LAMPS

A. Fluorescent lamps shall be energy saving type, of size, 35K and wattage as

scheduled on the drawings. They shall be General Electric "Watt-Miser", or equal as manufactured by Sylvania or Philips-Norelco.

B. Incandescent lamps shall be of type and size as scheduled on the drawings. They shall be rated 130 volts for longer life.

C. Other lamps, such as high intensity discharge or quartz, shall be of size and type as scheduled on the drawings and shall in all cases be compatible with the fixture in which they are to be used.

2.04 AUTOMATIC LIGHTING CONTROLS

A. See sheet E0.1 for specification for Automatic Lighting Control System.

PART 3 EXECUTION

3.01 INSTALLATION AND SUPPORTING METHODS

A. Surface mounted fixtures on suspended acoustical ceilings shall be firmly mounted on an outlet box which has premanufactured support brackets which span a minimum of two T-bars or support runners and attach to T-bars or support runners at a minimum of four (4) points (or continuously). Surface mounted linear fluorescent fixtures shall be attached to T-bars with caddy clips at a maximum of 4' on center. (Fluorescent strips shall use 1-1/2" offset brackets).

B. Surface mounted (wall or ceiling) fixtures on hard finish construction such as gypsum board, stucco, plaster or E.I.F.S. shall be attached to outlet boxes which are supported by a premanufactured brace which spans a minimum of two ceiling (or wall) structural members. Outlet boxes which support fixtures weighing 20 pounds or more shall have two (2) such braces.

C. Recessed fixtures shall be installed utilizing premanufactured mounting brackets which span a minimum of two (2) ceiling structural members at a minimum of four (4) points (or continuously). Conduit, wire or pipe strapping may not be used for such purposes. Fixtures which weigh more than 20 pounds shall additionally be supported from building structure by a minimum of four (4) safety wires or cables (minimum 12 Ga. Steel).

D. Suspended fixtures shall be mounted to outlet boxes and ceiling structural members installed as described for surface mounted fixtures using pendants or cables as indicated. There shall be not less than two (2) such pendants or cables for each 8 foot long fixture. Pendants or cables shall be designed to allow suspended fixtures to hang plumb and level for their entire length (or length of continuous rows), regardless of ceiling slope or irregularities. Canopies shall fit flush with ceiling finish on all sides.

3.02 FIXTURE TRIM

A. All fixtures, regardless of specified catalog number or mounting shall be provided with the proper trim and hardware for each application. Fixture trims shall completely cover all rough openings and fit flush with surface on all sides.

3.03 FIXTURE WIRING

A. Fixtures in non-accessible ceilings shall be directly wired using "THHN (or THWN in wet locations)" cable.

B. Outlet boxes for surface mounted or suspended fixtures shall be wired using "THHN (or THWN in wet locations)" cable.

C. Surface mounted or suspended continuous rows of fluorescent fixtures may use premanufactured plug-in wiring systems which utilize polarized fully rated nylon connectors in each fixture for continuous row energizing. Unswitched circuits for lamps connected to onboard emergency battery packs shall be directly wired using conduit.

3.04 LAMPS

A. All lamps shall be new and burning at the time of substantial completion. Fluorescent lamps which have been in use by the Contractor for 180 days or more shall be replaced. Lamps which are flickering, discolored or producing deficient color or lumen output shall be replaced. Incandescent lamps in use for 100 hours or more shall be replaced.

3.05 BALLASTS

A. All ballasts shall be new and operational at the time of substantial completion. All ballasts which are noisy or producing reduced lighting levels shall be replaced. Ballasts shall be covered by the Contractor's warranty as specified under DIVISION 1.

END OF SECTION 265100

SECTION 270000 - TELECOM COMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of General Requirements/Provisions shall be considered a part of this section and shall have the same force as if printed herein full. In addition, all information related to communications infrastructure that is documented in the architectural, structural, mechanical, and electrical drawings/documents shall be included as part of the Communications documents.

B. The telecommunications voice, data & coax & fiber cabling within these specifications may be provided by a telecommunication contractor TSC. If a separate contractor is performing the work, it is extremely important that the TSC review all the drawings and specifications provided in division 270000, 280000 and any other low voltage specifications or drawings here in.

C. The TSC shall conform to the same requirements written both in this section and 280501 Security Electronics General.

1.02 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. The 2011 edition of the National Electrical Code (NFPA 70)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturers Association (NEMA)
4. Telecommunications Industries Association (TIA)
5. Electronic Industries Association (EIA)
6. Institute of Electrical & Electronics Engineers (IEEE)
7. Underwriters Laboratories (UL)
8. American Standards Association (ASA)
9. Federal Communications Commission (FCC)
10. Occupational Safety and Health Administration (OSHA)
11. American Society of Testing Material (ASTM)
12. Americans with Disabilities Act (ADA)
13. Local city and county ordinances governing electrical work
14. In the event of conflicts, the more stringent provisions shall apply.

B. The ESC scope of work shall consist of, but not be limited to the following as defined in the details of this division of the specifications and as shown on the plans.

1. Firestopping
2. Pathways
3. Underground Conduits
4. Identification for Telcom and Security Systems
5. Commissioning for all Systems
6. Entrance Protection
7. Terminal Blocks and Patch Panels
8. Copper Backbone
9. Fiber Optic Backbone
10. Copper Horizontal Cable
11. Faceplates and Connectors
12. Patch Cords and Work Station Cords

13. Wireless Access Points and WIFI units

1.03 SCOPE

A. The work to be done under this section of the Specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings and as specified herein.

B. All materials, obviously a part of the Communications Infrastructure and necessary to its proper operation, but not specifically mentioned and shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.04 WORK INCLUDED

A. The Communications Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

A. Voice/Data Cabling Infrastructure
B. CATV Cabling Distribution System
C. Wireless Access System
D. Communications conduits, raceways, racks, cabinets and equipment mounting boards
E. Grounding and Bonding
F. Underground raceway excavation, backfill, and compaction
G. Concrete work for duct banks, maintenance holes, handholes, vaults and restoration.

1.05 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 27 - Communications:

B. Provide: As used herein shall mean “furnish, install and test (if applicable) complete.”

C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.

D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

E. TSC – TeleCommunication System Contractor

1.06 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all architectural drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as indicated on the Drawings,” “In accordance with,” “a,” “the” and “all are intended” shall be supplied by inference.

1.07 SUBMITTALS

A. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Three (3) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.
2. Contractor shall generate shop drawings. Modify reviewed and accepted shop drawings to include revisions based upon completion of work. Submit shop drawings with record drawings on hard copy.
3. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction drawings.

B. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

C. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the

responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

1.08 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.09 CONTRACTOR QUALIFICATION

A. The TSC Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated communications systems.

B. Communications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Architect of the following:

1. List of previous projects of this scope, size and nature; including names and sizes of projects, description of work, time of completion and names of contact persons for reference.
2. Shall certify that they are manufacturer-authorized for work to be performed.

C. Contractor must employ at least one (1) full-time Registered Communications Distribution Designer (RCDD). The RCDD shall be a W2 employee and not a subcontractor.

D. The TSC shall not be a subcontractor to the ESC or the Electrical Contractor. The TSC shall be fully licensed and bonded to perform the work listed on the TS drawings and division 27 specifications.

1.10 COORDINATION WITH OTHER TRADES

A. The TSC shall coordinate communications work with that of other sections as required to insure that the entire communications work will be carried out in an orderly, complete and coordinated fashion.

B. The TSC shall coordinate with the ESC and the electrical contractor for underground conduits and for systems cabling.

1.11 SITE INVESTIGATION

A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition before the completion of this project.

1.12 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

1.13 PREQUALIFICATION REQUIREMENTS

A. All TSC's must be pre-approved and listed. TSC's not listed as being approved that desire to bid the project must request approval and shall submit the following qualification information to the Architect in writing no later than ten (10) days prior to bid. Request received after this time will not be considered under any condition. If approval is received, acknowledgment will be by the noted special addendum. Verbal approval will not satisfy the right to bid. The TSC shall be named and listed on the bid form. Any bid forms containing the name of any TSC not listed and pre-qualified will not be considered and will be thrown out as a non-qualifying bid. All TSC's shall submit all information exactly as herein requested or approval will not be considered. Disqualification shall immediately exist if the request is submitted in a manner inconsistent and or incomplete as requested following. Disqualification shall also exist if in the opinion of the Architect and or Consultant, the information submitted is inaccurate or does not satisfy the qualification requirements.

B. The Architect / Consultant reserve the right to disqualify and or not approve any ESC for any reason if they deem it to be in the best interest of the Owner.

C. The ESC shall be a true systems integrator specializing in the design, manufacture, installation and servicing of integrated security electronics and communication control systems.

D. The evaluation of each perspective TSC's qualifications will be strictly and solely based on the qualification proposal. The proposal's format must be on a paragraph-by-paragraph basis to the items listed following:

1. Provide a history of the company that reflects accurately the length of time the company has been licensed and performed services of an TSC. The company shall have been in business under and incorporated under the name submitted in the proposal for a minimum of ten (10) years. For companies with multiple offices, the proposal must contain information based only on the location that will be responsible for the entire management and operations for this project from award of bid through the warranty period.
2. Provide a complete company organizational chart to include the owner(s), officers and key individuals.
3. Provide an organizational chart to include the names and positions of the Project Manager, Engineering Manager, the principal Project Engineer, the Project Programmer(s), the Manufacturing Manager, the Project Superintendent, the Lead Technician, all Field Technicians and Technical Support Staff that are to be assigned to this project.
4. For each of the individuals listed in the organizational chart, provide complete resumes and a delineation of each individual's responsibilities for this project. The resumes must include information about the individual's education, electronics systems detention experience, systems integration capabilities, factory training and certification and the length of time employed by the TSC. Provide a copy of each individual's manufacturer's certificate of certification for all systems, equipment and software for which each individual that will be involved.
5. The TSC must employ and provide the names and resumes of the

following resident staff personnel in its employ and such individuals must have oversight of the project. The resumes shall include the same information as listed in paragraph 4 above plus a copy of the certificates of certification required for each:

a. A Low Voltage Applications Employee.
b. A UL Trained Applications Employee.

6. Provide a list of the ten (10) most recently completed projects involving the major systems similar to those described in these specifications for which the TSC has been the integrator and having furnished and installed. Each project shall be of the size, complexity and requirements of this project and must have been in successful operation for a minimum period of three (3) years. If more than ten (10) projects are listed, only the first ten (10) will be reviewed. Provide the following information for each project:
   a. Project name and location.
   b. Date project was completed.
   c. Total project value.
   d. Contract amount to the TSC.
   e. Names of the TSC's Project Manager, Principal Project Employee and Field Superintendent.
   f. Name and telephone number of Architect.
   g. Name and number of the Security Consultant.
   h. Name and number of the Architect's Project Manager and Site Project Engineer.
   i. Name and number of an individual (preferably the maintenance manager) at each facility who is familiar with the operation, performance and maintenance of the facility's security electronic system. Reference must be current or the TSC will be considered non-responsive.
   j. List and description of all systems on the project and the approximate value of each.
7. Provide a list of all completed projects, which the TSC has been, the integrator and having furnished and installed. Provide the following information for each project:
   a. Project name and location.
   b. Date project was started.
   c. Total project value.
   d. Contract amount to the TSC.
8. Provide a list of all current projects, which the TSC is the integrator and is furnishing and installing. Provide the following information for each project:
   a. Project name and location.
   b. Date project was started.
   c. Total project value.
   d. Contract amount to the TSC.
9. Provide a list of all projects, which the TSC was involved in any form of litigation. Provide the following information for each project:
   a. Project name and location.
   b. Date project was started or completed.
   c. Total project value.
   d. Contract amount to the TSC.

10. Provide a list of all projects, which the TSC was assessed liquidated damages, even those projects for which the TSC did not have to pay a claim. Provide the following information for each project:
    a. Project name and location.
    b. Date project was started.
    c. Total project value.
    d. Contract amount to the TSC.
11. Provide a current independently audited and certified financial statement showing a consolidated net worth of $1,000,000.00.
12. Provide a letter from the Surety Company reflecting the Surety Company's history with the TSC. The letter must state the position of the Surety relative to providing a 100% payment and performance bond should a contract be awarded to the TSC. The letter must be an original and include a current issue date and reference this project and state the estimated value of the ESC contract. Even though the TSC may be a subcontractor to the DEC, the TSC will be required to provide both a bid bond to bid (cashiers check or bank letter will not be acceptable) and a performance and payment bond in order to perform the work.
13. Provide UL certificate and UL qualification number attesting to the TSC's approval and certification by UL that they are a UL listed Industrial Control Panel manufacturer.
14. Provide UL certificate and UL qualification number attesting to the TSC's approval and certification by UL that they are a UL listed Information Technology Equipment supplier.
15. Provide BICSI certificate and BICSI qualification attesting to the TSC's approval and that they are BICSI authorized.
16. The TSC shall confirm in writing that they will have qualified personnel available to be on the project site daily for any and all coordination purposes throughout the total duration of the project. Provide the name(s) and resume(s) and the individual(s).

E. Systems, equipment and products specified in this division shall be engineered, programmed, manufactured and assembled, installed and serviced by an approved TSC.

F. All work is to be performed in strict accordance to any and all applicable codes, ordinances, regulations and standards; Federal, state, local and otherwise including but limited to the following:
    1. National Electrical Code (NEC), latest edition
    2. National Fire Protection Association (NFPA)
    3. Factory Mutual System (FM)
    4. Electronics Institute of America (EIA)
    5. BISCI
    6. Telecommunications Industry Association (TIA)
    7. Underwriters Laboratory (UL)

G. Provide a statement attesting that the ESC has reviewed the entire set of bid documents not just Division 27 and understands the specified system and project requirements.

H. Provide a riser diagram for each system specific to this project depicting all relevant details and information inclusive of but not limited to equipment layout and locations, conduit routing and sizing, cable and wiring requirements and power requirements.

I. Provide for each system specified a delineation of the task required to be

performed by the TSC. Provide technical proposals reflecting the TSC's experience in the field of scope.

J. Provide a narrative description of all software to be used including programmable logic controllers, closed circuit television and video visitation.

K. Provide from each manufacturer of each system certification that the ESC and its applicable personnel have been factory trained and certified to manufacture /assembly, install and service equipment contained in each system.

L. Refer to each individual section of this division of the specification for the list of acceptable manufacturers. If the TSC preparing the proposal desires to request a substitute, he must do so within the confines of these proposal qualification requirements in writing twenty-one (21) days prior to the bid date. Manufacturers and equipment substitution proposal request must be submitted noting section, page, paragraph and item with a detailed cross-referencing and comparison. For proposed substitutions submit the following information exactly as requested:
   1. Name of manufacturer
   2. Address of manufacturer
   3. Phone number of manufacturer
   4. Trade name
   5. Model and catalog designation
   6. Performance and test data
   7. Referenced standards
   8. Warranties
   9. Material construction
   10. Finish

M. Electronic components shall be from manufacturers who at present have not less than ten (10) years continuous successful experience in the design and manufacture of the type products required for this project.

N. In order to meet the high standard requirements for Quality Assurance, proprietary and custom systems are not acceptable. Integrators listed as being approved and/or Integrators having been approved by addendum shall use products as specified and defined by these specifications.

O. All low voltage components shall be nationally available, off the shelf products.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. The Engineer's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Engineer. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to the Architect at least ten days prior to bid opening.

2.02 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply

with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.03 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. "Conveniently accessible" is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.04 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.05 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.06 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.

B. The Contractor shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the communications systems, components and subsystems meet Specification requirements in the "as-installed" operating environment during the "System Operation Test." Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and

other environmental parameters and the environmental conditions, which were encountered during the "System Operation Test."

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Communications Contractor Project Manager and submitted for approval.

END OF SECTION – June 17, 2024

SECTION 270510 - FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Firestopping Manufacturer(s)

1. Flamestopper Thru-Wall Fitting - Wiremold Company (Firestop Devices)
2. Unique Firestop Products (Firestop Devices)
3. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
4. Hilti (Putties, Caulks, Sealants, etc.)

2.02 TYPES OF PRODUCTS

A. Sealants

1. Intumescent Firestop Sealants and Caulks
2. Latex Firestop Sealant
3. Acrylic Water-Based Sealant
4. Silicone Firestop Sealants and Caulks
5. Firestop Putty
6. Firestop Collars
7. Wrap Strips
8. 2-Part Silicone Firestop Foam
9. Firestop Mortar
10. Firestop Pillows
11. Elastomeric Spray
12. Accessories:
13. Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation

B. Firestop Devices

1. Thru-Wall Fitting (Flamestopper by Wiremold)
   a. The firestop device box shall be constructed of 16 gage G90 steel.
   b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375°F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
   c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16 gage G90 steel with No. 10-32 screws use to adjust opening size.
   d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
   e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.
2. Threaded Firestop Device (Unique Firestop Products)
   a. Threaded steel sleeve device incorporating flat washers secured by threaded device shall be installed around cables. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
3. Smooth Firestop Device (Unique Firestop Products)
   a. Smooth steel sleeve device incorporating flat washers secured by sliding compression couplers. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
4. Split-Sleeve Firestop Device (Unique Firestop Products)
   a. Threaded steel sleeve halves incorporating split couplings and slotted washers to fit the specific diameter of the opening. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
5. Fire Rated Cable Pathway (STI EZ-PATH)
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0-100 percent cable fill.

2.03 UL CLASSIFICATION

A. Thru-Wall Fitting - The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark.

B. Threaded, Smooth and Split-Sleeve Firestop Devices - Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number. UL Classification system numbers are as follows:
   1. Threaded Firestop System
      a. Block Wall - W-J-3049
      b. Dry Wall - W-L-3138

2. Threaded Firestop System (Vertical)
   a. Slab - F-A-3010
3. Smooth Firestop System
   a. Block Wall - W-J-3048
   b. Dry Wall - W-L-3137
4. Split-Sleeve Firestop System
   a. Block Wall - W-J-3047
   b. Dry Wall - W-L-3136

2.04 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System:
   1. The device shall be classified for use in one-, two-, three, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating of six cfm. The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems:
   1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
   2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
   3. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions

C. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

PART 3 - EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General
   1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations
   1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations
   1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps
   1. Firestopping shall be provided between the edges of floor slabs and exterior walls, between the tops of walls and the underside of floors, in the control joint in masonry walls and floors and in expansion joints.

E. Smoke-Stopping
   1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.

C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. General
   1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
   2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
   3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
   4. Seal holes and penetrations to ensure an effective smoke seal.
   5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
   6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
   7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction
   1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

3.04 FIELD QUALITY CONTROL

A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
B. Follow safety procedures recommended in the Material Safety Data Sheets.
C. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.
D. All areas of work must be accessible until inspection by the applicable Code Authorities.
E. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.05 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
B. Leave finished work in a neat and clean condition with no evidence of spill-overs or damage to adjacent surfaces.

3.06 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 270526 - GROUNDING & BONDING FOR TELECOM SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Grounding and Bonding for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor Manufacturer(s)
   1. Southwire
   2. Or Approved Equal

B. Approved Grounding Lug Manufacturer(s)
   1. Burndy
   2. Thomas & Betts
   3. Or Approved Equal

C. Approved Grounding Busbar Manufacturer(s)
   1. Chatsworth Products, Inc.
   2. B-Line
   3. Harger

2.02 GROUNDING CONDUCTORS

A. Grounding Conductor
   1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
   2. Jacket color shall be green or black. Black jacketed cable shall be identified at each termination point with a wrap of green tape.

2.03 GROUNDING LUGS

A. Grounding Lugs and Hardware
   1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the cripmer impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless steel bolts and

washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.04 GROUNDING BUSBARS

A. Grounding Busbar

1. The grounding busbar shall be made of 1/4" thick solid copper.
2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
3. The grounding busbar shall accommodate 2-hole compression lugs.
4. The grounding busbar shall meet or exceed ANSI/TIA-607-B requirements.

PART 3 - EXECUTION

3.01 GROUNDING

A. The facility shall be equipped with a Communications Bonding Backbone (TBB). This backbone shall be used to ground all communications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-B Telecommunications Bonding and Ground Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding busbar (TMGB). Each telecommunications room (TR) shall be provided with a telecommunications ground busbar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MC/IC/TC shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.

D. All wires used for communications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-A.

E. See Section 27 05 43 - Underground Ducts and Raceways for Communications Systems for underground duct and raceway systems ground requirements.

3.02 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown

B. Non-Metallic (PVC) Manufacturer(s)
   1. Carlon
   2. Georgia Pipe Company
   3. Or Approved Equal

C. Electrical Metallic Tubing (EMT) Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown

D. Electrical Non-Metallic Tubing (ENT) Manufacturer(s)
   1. Carlon
   2. Or Approved Equal

E. EMT Fittings Manufacturer(s)
   1. Thomas & Betts
   2. Steel City
   3. Or Approved Equal

F. ENT Fittings Manufacturer(s)
   1. Carlon
   2. Or Approved Equal

G. Innerduct/Inner-Conduit Channel Manufacturer(s)
   1. Carlon
   2. Endot Industries
   3. MaxCell
   4. Petroflex
   5. Eastern

H. Metallic Communications Outlet Box Manufacturer(s)
   1. Steel City
   2. Raco
   3. Or Approved Equal

I. Non-Metallic Communications Outlet Box Manufacturer(s)
   1. Thomas & Betts
   2. Carlon
   3. Or Approved Equal

J. Pull Box Manufacturer(s)
   1. Hoffman
   2. OZ Gedney
   3. Or Approved Equal

K. Approved Cable Hanger Manufacturer(s)
   1. Erico Products – Caddy
   2. B-Line
   3. Or Approved Equal

L. Approved Tie Wrap/Velcro Strap Manufacturer(s)
   1. Leviton
   2. Panduit
   3. Or Approved Equal

2.02 CONDUIT

A. Rigid and Intermediate Conduit
   1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.

B. Non-Metallic (PVC) Conduit
   1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.
   2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. Electrical Metallic Tubing (EMT)
   1. Electrical metallic tubing (EMT), couplings and connectors shall be steel. Malleable iron, pressure-cast or die-cast fittings are not permitted.
   2. Fittings for 2" EMT and smaller shall be steel set screw type, except where otherwise noted. Fittings for 2.5" and larger shall be steel set screw type with two (2) screws for connectors and four (4) screws for couplings. All connectors shall be insulated throat type.

D. Electrical Non-Metallic Tubing (ENT)
   1. ENT shall be a pliable, non-metallic raceway manufactured of the same PVC material used for rigid non-metallic conduit.
   2. Fittings and outlet boxes shall be designed for use with ENT and listed by Underwriters Laboratories.

E. Conduit Support

1. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2 inch and smaller with 1/4 inch threaded steel rods and use 3/8 inch rods for 2 inch and larger.
2. Conduit support channels shall be 14 gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Attach suspension rods to structure with swivel type connectors. Conduit straps shall be spring steel type compatible with channel.
3. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

F. Innerduct/Inner-Conduit Channel
1. Innerduct shall be corrugated plastic equipped with pull-string or mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct / inner-conduit channel (MaxCell) details.

2.03 METALLIC COMMUNICATIONS OUTLET BOXES
A. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16" thick.
B. The dimensions of the metallic outlet box shall be 4" x 4" square with a minimum depth of 2-1/8".
C. Metallic outlet boxes shall be equipped with single device covers (or two-device covers where needed). Where installed in plaster, gypsum board, etc., covers shall be raised to compensate for the thickness of the wall finish.
D. Where metallic outlet boxes are to be empty for future use, blank coverplates shall be used.

2.04 NON-METALLIC COMMUNICATIONS OUTLET BOXES
A. The non-metallic outlet box shall be thermoplastic and be rated according to the space it occupies.
B. The dimensions of the non-metallic outlet box shall be approximately 4" x 4" square with a minimum depth of 2-1/8".
C. Non-metallic outlet boxes shall be equipped with single device covers. Covers shall be raised to compensate for the thickness of the wall finish.
D. Where non-metallic outlet boxes are to be empty for future use, blank faceplates shall be used.

2.05 PULL BOXES
A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.
B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.
C. Pull boxes shall have provisions for grounding.

2.06 CABLE HANGERS
A. J-Hooks

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be cULus Listed.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

B. Adjustable Non-Continuous Cable Support Sling
1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair balanced twisted pair cables; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable. Cable support sling shall be cULus Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

2.07 TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps
1. Cables shall be fastened to support structures with tie wraps/Velcro straps.
2. Tie wraps/Velcro straps installed in air handling spaces must be plenum rated.
a. Non-plenum Tie Wrap color shall be black.
b. Plenum Tie Wrap color shall be red.
c. Non-plenum Velcro strap color shall be black.
d. Plenum Velcro strap color shall be red.

PART 3 - EXECUTION

3.01 PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.
B. Holes shall be located so as not to affect structural sections such as ribs or beams.
C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.
D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.
E. All penetrations where conduit is not used shall be sleeved.
F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.02 CONDUIT SYSTEM

A. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.
B. Leave all empty conduits with a 200 pound test nylon cord pull line.
C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
D. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.
E. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.
G. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.
H. Where conduits must pass through structural members obtain approval of Architect.
I. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
K. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (G.R.S.) or intermediate metal conduit (IMC). Service entrance conduits shall be installed "outside" of the building as defined by the N.E.C. Provide concrete encasement where required or as indicated on Drawings.
L. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT) or electrical non-metallic tubing (ENT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.
M. Conduit Installations Within Slab/Floor
    1. Conduit shall be run following the most direct route between points.
    2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
    3. Conduits shall not be installed within shear walls unless specifically indicated on the Drawings. Conduit shall not be run directly below and parallel with load bearing walls.
    4. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
    5. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.

6. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.
7. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
8. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.) or Schedule 40, heavy wall PVC.

N. Communications cables shall not occupy conduits with power cables.
O. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-B.
P. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
Q. Communications conduit system shall contain no condulets (also know as an LB).
A. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.
B. Horizontal Conduits
1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
3. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.03 COMMUNICATIONS OUTLET BOXES
A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.
B. The approximate locations of the outlets are indicated on the Drawings. The exact locations of outlets shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.
C. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.
D. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.
E. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.

F. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.04 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.
B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.
C. Pull boxes shall be free from burrs, dirt and debris.
D. Pull boxes shall be installed in accordance with ANSI/TIA-569-B.
E. Pull boxes shall be grounded in accordance with ANSI/TIA-607-B.

3.05 CABLE HANGERS

A. Installation and configuration shall conform to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1 & ANSI/TIA-569-B, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
B. Install cables using techniques, practices, and methods that are consistent with Category 5e or higher requirements and that supports Category 5e or higher performance of completed and linked signal paths, end to end.
C. Install cables without damaging conductors, shield, or jacket.
D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
E. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.
F. Do not exceed load ratings specified by manufacturer.
G. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
H. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.06 TIE WRAPS AND VELCRO STRAPS

A. Tie wraps/Velcro straps shall be installed around cables at intervals of 12" minimum.
B. Tie wraps shall secure cables to cable trays using an "X" pattern.
C. Do not over-cinch cables.

3.07 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 270543 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Underground Ducts and Raceways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)
   1. Allied
   2. Triangle
   3. Wheatland
   4. Youngstown

B. PVC/HDPE Conduit Manufacturer(s)
   1. Carlon
   2. Georgia Pipe Company
   3. FiberTel
   4. Or Approved Equal

C. Innerduct/Inner-Conduit Channel Manufacturer(s)
   1. Carlon
   2. Endot Industries
   3. MaxCell
   4. Petroflex

D. Marker Tape Manufacturer(s)
   1. William Frick & Associates
   2. Or Approved Equal

E. Approved Maintenance Hole/Handhole Manufacturer(s)
   1. Old Castle
   2. Pencell (Handholes Only)
   3. Quazite (Handholes Only)
   4. Or Approved Equal

F. Approved Conduit Plug/Cap Manufacturer(s)

1. Jack Moon
2. Or Approved Equal

2.02 CONDUIT SYSTEM

A. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

B. Concrete shall have a minimum strength of 2,500 psi at 28 days.

C. PVC conduit for direct burial shall be Schedule 40, UL Labeled for 90 degrees C cables. Fittings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.

D. Rigid and Intermediate Conduit

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.
2. Galvanized rigid steel conduit shall be hot dipped galvanized inside and outside, in 10 foot lengths and threaded on both ends. Fittings and bushings shall be threaded, cast or malleable iron, and hot dipped galvanized inside and outside.

E. Non-Metallic Conduit

1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC / HDPE.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

F. Conduit Support

1. Conduit straps shall be single-hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

G. Innerduct/Inner-Conduit Channel

1. Innerduct shall be non-corrugated PVC equipped with mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct/inner-conduit channel (MaxCell) details.

H. Marker Tape

1. Marker tape shall be detectable, orange for communications, and labeled to indicate the type of circuit buried below.

2.03 MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.

6. The cover for maintenance holes shall have the lettering, "COMMUNICATIONS."

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.
2. Handholes shall be equipped with racking for cable storage.
3. Handholes shall have the word "COMMUNICATIONS" molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
4. Handholes shall be able to withstand 10,000 lbs minimum.
5. See Drawings for handhole dimensions and locations.

2.04 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.
2. Conduit plugs shall be conduit size specific.
3. Triplex and Quadplex duct plugs shall provide a watertight seal between the conduit and innerduct(s).
4. Simplex duct plugs shall provide a watertight seal between the innerduct and the cable that occupies it.

PART 3 - EXECUTION

3.01 CONDUIT SYSTEM

A. Excavation and Backfill

1. Contractor shall call underground utilities locator company before digging.
2. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.
3. Barriers shall be provided to protect landscaping adjacent to the excavation area.
4. When rocks, concrete or other debris are encountered during excavation, remove completely.
5. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.
6. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.
7. Backfill excavations in 6-inch layers and mechanically compact to 98 percent compaction.
8. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.
9. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.
10. Backfill the last 6 inches with clean topsoil. Reseed lawn areas.
11. Restore concrete sidewalks and asphalt.
12. The Contractor shall perform all excavation to install the electrical work herein specified and as indicated on Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench

to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut.

13. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
14. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and rammed until the installation has a cover of not less than the adjacent ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off

B. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes/handholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes handholes into buildings. Duct banks shall not contain traps between maintenance holes/handholes where water may accumulate.
2. Directional changes in duct banks shall be made with 20' minimum radius bends. Duct banks and direct buried ducts shall be supported on undisturbed soil or on piers extending down to undisturbed soil.
3. Where power and communications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
4. Prior to concrete encasement, ducts, reinforcing steel and ground wires shall be secured with nonmetallic straps or cable ties to nonmetallic duct spacers at intervals not exceeding 8 feet. Duct spacers shall be sized for the ducts being held, and shall provide the minimum spacing between ducts required for concrete flow and by the NEC. Duct spacers shall be anchored to the ground using nonmetallic bands and stakes.
5. Duct banks shall have a minimum of 3 inches of concrete cover on all sides.
6. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
7. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
8. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.

9. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.
10. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.
11. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.
12. An orange detectable marker tape (for communications) shall be buried in the backfill approximately 12 inches above duct banks or direct buried cables for the entire length of the duct run.
13. A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.
14. Ducts shall be identified in the maintenance holes and at both ends.

C. Additional OSP Conduit Requirements
1. Leave all empty conduits with a 200-pound test nylon cord pull line.
2. Install a #14 AWG tracer wire in one conduit for the entire length of each duct run.
3. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
4. Install conduit, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
5. Where conduits must pass through structural members obtain approval of Architect.
6. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
7. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
8. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC/HDPE. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Service entrance conduits shall be installed “outside” of the building as defined by the N.E.C. Provide concrete encasement where required or as indicated on Drawings.
9. Seal all conduits entering building to prevent entrance of moisture.
10. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments.
11. Below Grade Conduit Installations
    a. Install top of conduits 24 inches minimum below finished grade or as indicated on Drawings.
    b. Install top of conduits 6 inches minimum below bottom of building slabs.

c. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab.

12. Communications cables shall not occupy conduits with power cables.
13. All metallic conduits shall be grounded in accordance with ANSI/TIA-607-B.
14. For runs that total more than 400 feet in length, insert handholes/maintenance holes so that no segment exceeds the 400 feet limit.
15. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
16. Communication conduit system shall contain no condulets (also known as an LB).

3.02 MAINTENANCE HOLES/HANDHOLES

A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.
B. Tops of maintenance holes/handholes shall be level with the existing grade.
C. Ducts should enter as perpendicular to the wall surface as possible.
D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.03 CONDUIT PLUGS/CAPS

A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.
B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.

3.04 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17,2024

SECTION 270553 - IDENTIFICATION FOR TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Identification for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - LABELING

2.01 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-A document, manufacturer's recommendations and best industry practices.

B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.

C. All labels shall be clear with black text.

D. All cables shall be labeled with machine generated, wrap around labels.

E. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet' 12" from termination block/patch panel.

F. Labeling scheme shall be alphanumeric.

PART 3 - NOT USED

END OF SECTION – December 11, 2023

SECTION 270800 - COMMISSIONING OF TELECOMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - TESTING

2.01 TESTING REQUIREMENTS

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Copper Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 6 performance. Horizontal balanced twisted pair cabling shall be tested using a level IIe, III, or IV test unit for category 6 performance compliance.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be

recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

4. Approved tester is as follows:

Fluke DTX

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the RFP and/or Drawings. These tests also include continuity checking of each fiber.
2. Multimode
   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter/light source. Fiber must be tested at both 850nm and 1300nm. Maximum attenuation dB/Km @ 850nm/1300nm shall be 3.5/1.5. Maximum attenuation per connector pair shall be .75 dB. Attenuation testing shall be performed with a stable launch condition using a one-meter or two-meter jumper, wrapped around a mandrel sized according to fiber type, to attach the light source to the cable plant. Fiber jumper shall be wrapped around mandrel no less than five (5) times. The jumper-mandrel assembly shall remain connected to the light source after calibration and the power meter moved to the far end using a new jumper to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.
3. Singlemode
   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter/light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation dB/Km @ 1310nm/1550nm shall be 0.5/0.5 for outside plant and 1.0/1.0 for inside plant. Maximum attenuation per connector pair shall be .75 dB. Attenuation testing shall be performed with a stable launch condition using one-meter or two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.
4. Approved optical fiber test equipment manufacturers are as follows:
   a. Power Meters & Light Sources

   Optical Wavelength Laboratories (OWL)
   Noyes
   Photonix
   Fluke
   Agilent

   b. Optical Time Domain Reflectometers (OTDR)

   GN Nettest
   Agilent
   Fluke

Anritsu
Tektronix

D. Coaxial Testing
1. Sweep testing of each reel of coaxial cable shall be performed over the 5 MHz through 1 GHz range by the cable manufacturer for transmission and structural return loss and be so certified in writing by the cable manufacturer.
2. Verification testing with a verification field test instrument will determine shorts, continuity, termination location and length of cable.
3. Approved testers are as follows:
Fluke DTX
4. Signal strength measurement shall be performed with a field strength meter.
5. Signal level at each outlet will be +5 dBmv, + 3 dB.
6. Approved signal strength meters are as follows:
Acterna
Sadelco
Promax

E. Test Results
1. Test documentation shall be provided on disk as part of the as-built package. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation,” the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the Contractor may furnish this information in electronic form (CD). These CDs shall contain the electronic equivalent of the test results as defined by the Specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.01 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for communications work shall include:
1. Cable routing and identification
2. System function diagrams
3. Manufacturers' description literature for equipment

4. Connection and programming schedules as appropriate
5. Equipment material list including quantities
6. Spare parts list with quantities
7. Details not on original Contract Documents
8. Test results
9. Warranties
10. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2006 or later. Submit as-built drawings electronically on C.D. and hard copy.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole
2. Maintenance manuals for components and for system as a whole
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details
4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements
6. Delivery time frame for replacement of component parts from suppliers
7. Recommended inspection schedule and procedures for components and for system as a whole
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole
10. Troubleshooting procedures for each system and for each major system component

3.03 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

3.04 WARRANTY

A. General
   1. All equipment is to be new and warranted free of faulty workmanship and damage.
   2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
   3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Voice & Data Structured Cabling
   1. Manufacturer(s) shall provide a minimum 25-year warranty for components used in the installed Voice & Data Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Coaxial Cabling Infrastructure
   1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Coaxial Cabling Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

D. CATV Distribution System
   1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed CATV Distribution System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

E. Wireless Access System
   1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Wireless Access System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

F. Pathway & Support Infrastructure
   1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION – June 17, 2024

SECTION 271119 - TELECOMMUNICATIONS TERMINATION BLOCKS & PATCH PANELS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks and Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Patch Panel Manufacturer(s)
   1. Leviton
   2. Siemon
   3. Panduit

B. Approved Optical Fiber Enclosure Manufacturer(s)
   1. Leviton
   2. Siemon
   3. Panduit

C. Approved Termination Block Manufacturer(s)
   1. Leviton
   2. Siemon
   3. Panduit

2.02 PATCH PANELS

A. Category 6 Patch Panel
   1. The Category 6 patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
   2. The Category 6 patch panel shall be equipped with 8-position modular ports and shall allow for termination using both T568A and T568B wiring schemes.
   3. The Category 6 patch panel shall be equipped with front labeling space to facilitate port identification.
   4. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.

2.03 OPTICAL FIBER PANELS/ENCLOSURES

A. Rack Mount Optical Fiber Panel/Enclosure

1. The rack mount optical fiber panel/enclosure shall be equipped with either a swing out mechanism or a sliding drawer to access fibers.
2. The rack mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cable.
3. The rack mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.
4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The rack mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels.
   a. The optical fiber adapter panels shall accommodate either multimode or singlemode terminated optical fiber.
   b. The optical fiber adapter panels shall be compatible with LC connectors.
   c. OM1 & OM2 multimode adaptors shall be beige in color and equipped with phosphor bronze sleeves.
   d. OM3 laser optimized adaptors shall be aqua in color and equipped with zirconia ceramic sleeves.
   e. Singlemode adaptors shall be blue or green in color and equipped with zirconia ceramic sleeves.

2.04 TERMINATION BLOCKS

A. 110 Type Wiring Blocks/Cross-Connect Kits:

1. The 110-type wiring blocks shall be available in 100- and/or 300-pair configurations.
2. The 110-type wiring block shall be Category 6.
3. The cross-connect kits shall include all the components required to complete a wall-mounted 110 cross-connect installation and be available in both 100- and/or 300-pair configuration. (Includes 110-blocks, connecting blocks and designation strips).
4. The termination block shall meet or exceed the performance criteria per ANSI/TIA-568-C.2.
5. Backbone blocks shall use 5-pair connecting blocks on each 25-pair row.
6. Horizontal blocks shall use 4-pair connecting blocks on each 25-pair row.

B. 66-Blocks

1. The 66-type wiring block shall be a 50-pair configuration.
2. The 66-type wiring block shall have a split clip system using bridge clips to connect incoming pairs to outgoing pairs.
3. The 66 block's labeling system shall use designation strips or covers to accommodate labels.

PART 3 - EXECUTION

3.01 PATCH PANELS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 OPTICAL FIBER PANELS/ENCLOSURES

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.
B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
C. Bend radius of the optic fiber cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.
D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
F. A maximum of 12 strands of fiber shall be spliced in each tray
G. All spare strands shall be installed into spare splice trays.
H. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.03 TERMINATION BLOCKS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
D. Cables shall be neatly bundled and dressed to their respective termination block. Each termination block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
E. Each cable shall be clearly labeled on the cable jacket within 12" of the termination block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.
F. Wall mounted termination block fields shall be mounted on communications backboard.

G. Wall mounted termination block fields shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.04 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Optical Fiber Backbone Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. Provide a complete 0firewall for the fiber optic system

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Optical Fiber Backbone Cable (Inside Plant) Manufacturer(s)
   1. Superior Essex
   2. Siemon
   3. Cisco

B. Approved Optical Fiber Backbone Cable (Outside Plant) Manufacturer(s)
   1. Superior Essex
   2. Siemon
   3. Cisco

C. Approved Optical Fiber Connectivity Manufacturer(s)
   1. Leviton
   2. Siemon
   3. Cisco

D. Approved Splice Case Manufacturer(s)
   1. 3M
   2. Corning
   3. Cisco

2.02 OPTICAL FIBER BACKBONE CABLE (INSIDE PLANT)

A. Plenum - Indoor Distribution 850nm Laser-Optimized 50/125 Multimode Optical Fiber Non-Conductive (OFNP) Tight Buffered Cable (OM3)
   1. Generic Characteristics
      a. The indoor optical fiber cable shall be available with up to twelve 900-micron tight-buffered 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.

b. The indoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
c. The indoor optical fiber cable shall have sequential length marking printed on the cable jacket.
d. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5
e. Minimum overfilled modal bandwidth: 1500 MHz-km @ 850 nm.
f. Minimum overfilled modal bandwidth: 500 MHz-km @ 1300 nm.
g. Minimum effective modal bandwidth: 2000 MHz-km @ 850nm

B. Plenum - Indoor Distribution 8.3/125-micron Singlemode Optical Fiber Non Conductive (OFNP) Tight Buffered Cable
1. Generic Characteristics
a. The indoor optical fiber cable shall be available with up to twelve 900-micron tight-buffered, 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
b. The indoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
c. The indoor optical fiber cable shall have sequential length markings printed on the cable jacket.
d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
e. The loss of fiber shall not exceed 1.0 dB per kilometer @ 1550 nm and 1.0 dB per kilometer @ 1310 nm.

2.03 OPTICAL FIBER BACKBONE CABLE (OUTSIDE PLANT)

A. Indoor/outdoor 850nm Laser Optimized 50/125 Multimode Optical Fiber Non Conductive (OFNR) Loose Tube Cable (OM3)
1. Generic Characteristics
a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking gel.
b. The indoor/outdoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
c. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
d. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5
e. Minimum overfilled modal bandwidth: 1500 MHz-km @ 850 nm.
f. Minimum overfilled modal bandwidth: 500 MHz-km @ 1300 nm.
g. Minimum effective modal bandwidth: 2000 MHz-km @ 850nm

B. Indoor/outdoor 8.3/125-micron, Singlemode Optical Fiber Non Conductive (OFNR) Loose Tube cable
1. Generic Characteristics
a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking gel.
b. The indoor/outdoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.

c. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
e. The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.

2.04 OPTICAL FIBER CONNECTORS

A. Laser Optimized Multimode Fiber Connectivity OM3

1. The optical fiber field-installable connector shall be LC, for installation onto multimode a laser optimized 50/125-micron fiber.
2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers.
3. The optical fiber field-installable connector shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
4. The optical fiber field-installable connector shall have a maximum Loss of 0 .5 dB.
5. The optical fiber adapter module that occupies the faceplate shall be equipped with zirconia ceramic sleeve.
6. Laser optimized multimode fiber connector color shall be aqua.

B. Singlemode Fiber Connectivity

1. The optical fiber field-installable connector shall be LC, for installation onto singlemode 8.3/125-micron fiber.
2. The optical fiber field-installable connector shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
3. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers or 250-micron loose-tube fibers.
4. The preferred method of terminating loose-tube singlemode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
5. The splice loss through each connector pair shall not exceed 0.50 dB.
6. The optical fiber adapter module that occupies the faceplate shall be equipped with zirconia ceramic sleeve.
7. Singlemode fiber connector color shall be blue.

2.05 SPLICE CASES

A. Canister Splice Case

1. Splice cases shall be water tight and designed for outside plant applications.
2. All splice trays, seals and hardware shall be from the same manufacturer as the splice case.
3. Splice trays shall utilize heat-shrink seals.
4. See Drawings for size requirements.

PART 3 - EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.
B. Backbone cables shall be installed separately from horizontal distribution cables
C. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
E. Exposed cables must be OFNP rated if installed in an air return plenum. Riser rated cables shall be installed in metallic conduit if installed in an air return plenum.
F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
G. Leave 10' of slack on each end of fiber backbone cable.
H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
L. Each optical fiber cable shall be individually attached to the respective enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
M. Each optical fiber cable shall be clearly labeled at the entrance to the enclosure. Cables labeled within the bundle shall not be acceptable.
N. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
O. A maximum of 12 strands of fiber shall be spliced in each tray
P. All spare fiber strands shall be installed into spare splice trays.
Q. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.02 BACKBONE CABLES (OUTSIDE PLANT)

A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the fiber enclosure.
B. All cables shall be tagged and identified within each handhole/maintenance hole.
C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.
D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.
E. Ventilate maintenance where gas has been detected before entering the maintenance hole.
F. To ensure that the optical fiber cable's qualities and characteristics are not degraded during installation, excessive pulling tensions and short bending radii will not be allowed. The maximum pulling tension is 600 lbs. The minimum bending radius for cable under tension is 20 times the outside diameter of the cable and for cable at rest is 10 times the outside diameter of the cable.

G. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.
H. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.
I. Contractor shall coil 60 feet of spare optical fiber cable in each handhole/maintenance hole without a splice and 75 feet of each optical fiber cable in each handhole/maintenance hole with a splice. Cable coils shall have at least two points of support on the optical fiber racking system.
J. When mounting the optical fiber slack coils, the minimum bend radius shall not be exceeded; this radius is equal to 10 times the outside diameter of the cable in a static application and 20 times the outside diameter in a dynamic application. At anytime during the entire handling process of the optical fiber cable, as much care as possible should be maintained and all the manufacturer's recommendations should be followed.

3.03 OPTICAL FIBER CONNECTIVITY / SPLICING
A. Optical fiber connectors shall be installed as per the requirements specified by the manufacturer's installation guidelines.
B. All splicing shall be of the fusion type made under Light Injection and Detection Mode, whenever applicable. The Contractor shall provide certified and experienced personnel for splicing.
C. Contractor's tools and equipment shall be in excellent working order. Any worn or improperly working tools shall be discarded and not used on this project. All fusion splicers shall be calibrated and labeled according to the manufacturer's specifications. Contractor shall submit certification of calibration for the fusion splicers to the Engineer.

3.04 SPLICE CASES
A. Splice Cases shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.05 IDENTIFICATION
A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Copper Cable Manufacturer(s)

1. Superior Essex
2. Siemon
3. No Exceptions

2.02 HORIZONTAL COPPER CABLE

A. 100 OHM Category 6 Balanced Twisted Pair Cable

1. The horizontal balanced twisted pair cable shall meet or exceed the Category 6 transmission characteristics per issue of ANSI/TIA/EIA-568-C.2.
2. Cable jacket shall be CMR or CMP rated (according to the space it occupies).
3. Jacket color shall be:
   a. Gray for voice.
   b. Blue for data

PART 3 - EXECUTION

3.01 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-B maximum fill for the particular raceway type.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
E. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.
F. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
G. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.
H. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
I. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
J. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
K. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.
L. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
M. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.2 document, manufacturer's recommendations and best industry practices.
N. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
O. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
P. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 271543 - COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates and Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Connectivity Manufacturer(s)
   1. Leviton
   2. Systimax
   3. Siemon
   4. No exceptions

B. Approved Optical Fiber Connectivity Manufacturer(s)
   1. Leviton
   2. Systimax
   3. Siemon
   4. No Exceptions

C. Approved Coaxial Connectivity Manufacturer(s)
   1. Cable Connectors
      a. Gilbert
      b. PPC
      c. Digicon
      d. No Exceptions
   2. F-Connectors
      a. Leviton
      b. Systimax
      c. Siemon
      d. No Exceptions

D. Approved Faceplate Manufacturer(s)
   1. Leviton
   2. Systimax
   3. Siemon

4. No Exceptions

E. Approved Surface Mount Box manufacturer(s)
1. Leviton
2. Systimax
3. Siemon
4. No Exceptions

2.02 COPPER CONNECTIVITY

A. Voice/Data Jacks
1. Category 6, 8-Position, 8-Contact (8P8C) Modular Jack
a. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
b. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
c. The connector module shall be designed for use at the work area (WA), communications room (TR) and/or equipment room (ER) without modification.
d. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
e. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
f. Icons shall be used if offered from the manufacturer.
g. Jack/Icon colors shall be:
Gray for voice
Blue for data

2.03 FIBER CONNECTIVITY

A. Laser Optimized Multimode Fiber Connectivity OM3

1. The optical fiber field-installable connector shall be LC for installation onto multimode a laser optimized 50/125-micron fiber.
2. The optical fiber field-installable connector shall be compatible with 900-micron buffered fibers.
3. The optical fiber field-installable connector shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
4. The optical fiber field-installable connector shall have a maximum Loss of 0 .5 dB.
5. The optical fiber adapter module that occupies the faceplate shall be equipped with zirconia sleeve.
6. Laser optimized connector color shall be aqua.

2.04 COAXIAL CONNECTIVITY

A. Connectors shall be solderless, 75-Ohm impedance and be designed for the specific type of cable used.
B. Series-6 connectors shall be one piece. Series-11 connectors shall use the cable's center conductor as the connector's center pin.
C. All Series-6 and Series-11 connections shall be made with compression-type connectors.

D. Screw-on connectors are not acceptable.
E. The coaxial adapter module that occupies the faceplate shall be a 75-ohm, F-type connector.

2.05 FACEPLATES
A. Faceplates
1. The faceplate housing the connector modules shall have no visible mounting screws.
2. It shall be possible to install the connector modules in wall-mounted single- and dual-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
3. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
4. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.
5. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present or future network needs such as audio, video, coaxial and optical fiber applications.
6. Color shall be same as electrical faceplates.

PART 3 - EXECUTION

3.01 COPPER CONNECTIVITY
A. 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.
B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
C. Data jacks, unless otherwise noted in Drawings or fiber adapter modules are present, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).
D. Voice jacks, unless otherwise noted in Drawings, shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.02 OPTICAL FIBER CONNECTIVITY
A. Optical fiber connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.
B. Fiber adapter modules, unless otherwise noted in Drawings, shall be located in the bottom position(s) of each faceplate. Fiber adapter modules in horizontally oriented faceplates shall occupy the right-most position(s).

3.03 COAXIAL CONNECTIVITY
A. F-connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.
B. Cable preparation and connector application shall be done only with tools approved for use with the connector.

3.04 FACEPLATES

A. Blank inserts shall be installed where ports are not used.
B. The same orientation and positioning of jacks and connectors shall be utilized through out the installation.
C. Faceplates shall be installed straight and level.
D. Faceplates shall be installed at the same heights as electrical faceplates.

3.05 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 271619 - COMMUNICATIONS PATCH CORDS AND WORKSTATION CORDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Patch Cords and Workstation Cords.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Patch Cord/Workstation Cord Manufacturer(s)
   1. Leviton
   2. Systimax
   3. Siemon
   4. No Exceptions

B. Approved Fiber Patch Cord/Workstation Cord Manufacturer(s)
   1. Leviton
   2. Systimax
   3. Siemon
   4. No Exceptions

2.02 COPPER PATCH CORDS/WORKSTATION CORDS

A. Category 6 Patch Cords/Workstation Cords
   1. The Category 6 patch cord/workstation cord shall be 4-pair, with 24 AWG solid or stranded copper conductors and 8-position modular plug.
   2. The Category 6 modular cord cable shall be UL Listed as Type CMR.
   3. The Category 6 patch cord/workstation cord shall meet or exceed the requirements of ANSI/TIA-568-C.2.
      a. The Category 6 patch cord/workstation cord color for voice shall be: Gray
      b. The Category 6 patch cord/workstation cord color for data shall be: Blue

2.03 FIBER PATCH CORDS / WORKSTATION CORDS

A. Multimode Fiber Patch Cords/Workstation Cords
   1. 50/125-Micron 850nm Laser Optimized Multimode Fiber Patch Cord/Workstation Cord (OM3)
      a. The 50/125-micron fiber used in the multimode fiber patch cord/station cord shall have a maximum attenuation of 3.5dB/km@ 850 nm and 1.5 dB/km @1300 nm.
      b. The 50/125-micron 850nm laser optimized multimode fiber patch cord/station cord shall meet or exceed the requirements of ANSI/TIA-568-C.3.
      c. The optical fiber cord connector shall be LC.
      d. The multimode fiber cord assembly shall be dual zip jacketed.

B. Singlemode Fiber Patch Cords
   1. 8.3/125-micron singlemode fiber patch cord:
      a. The 8.3/125-micron fiber used in the singlemode fiber patch cord shall have a maximum attenuation of 1.0 dB/km @ 1310 nm and 1.0 dB/km @ 1550 nm.
      b. The optical fiber cord connector shall have a maximum insertion loss of 0.5 dB and a reflectance of -30 dB.
      c. The 8.3/125-micron singlemode fiber patch cord/station cord shall meet or exceed the requirements of ANSI/TIA-568-C.3.
      d. The optical fiber cord connector shall be LC.
      e. The singlemode fiber patch cord assembly shall be dual zip jacketed.
      f. Angle polish connectors shall be used for video distribution.

PART 3 - EXECUTION

3.01 COPPER PATCH CORDS/WORKSTATION CORDS

A. Copper patch cords/workstation cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 FIBER PATCH CORDS/WORKSTATION CORDS

A. Fiber patch cords/workstation cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

A. Refer to Section 270553 - Identification for Communications Systems for labeling details.

END OF SECTION – June 17, 2024

SECTION 272133 - WIRELESS ACCESS POINTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Wireless Access Points requirements.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturers' specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Indoor Wireless Access Point Manufacturer(s)
   1. Leviton / Meru
   2. Cisco

B. Approved PoE Switch / Controller Manufacturer(s)
   1. Leviton / Meru
   2. Cisco

C. Approved WIFI units
   1. Ubiquiti
   ~~2. Mist~~
   ~~3. Ruckus~~

PART 3 - EXECUTION

3.01 WIRELESS ACCESS POINTS

A. Wireless access points and supporting equipment shall be installed as per the requirements specified by the manufacturers' installation guidelines and best industry practice

B. Provide all necessary interconnections, services, and adjustments required for a complete and operable system.

C. Install control signal, communications, and data transmission line grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.02 FIELD QUALITY CONTROL

A. Testing

1. All devices shall be tested for full operational compliance.
2. Testing of system shall be the sole responsibility of the Contractor.

3.03 LABELING

A. Label all cables at each end of each cable. Labels shall be machine generated, wrap-around type.

B. Labeling system shall designate the cable's origin and destination on each end of each distribution/horizontal cable.

3.04 WARRANTY

A. All equipment, components, etc., shall be guaranteed free of defects and any faulty workmanship for a period of one year after final acceptance.

B. The Contractor shall replace defective materials and repair faulty workmanship within 24 hours of discovery at no cost to the Owner.

END OF SECTION – June 17, 2024

SECTION 280000 - SECURITY ELECTRONICS, GENERAL

PART 1 - GENERAL

1.01 SUMMARY.

A. This division of the specifications covers the complete security controls, communications and alarm systems as indicated on the drawings and specified herein. The Electronics Systems Contractor (ESC) shall be the single contractor responsible for this and all other divisions covered by the complete contract specification documents and any and all supplementary documents and addenda and shall provide all design, labor, material, equipment and supervision to install the specified equipment and systems for a complete integrated operational security systems package inclusive of any and all equipment to effect a complete and functional system in accordance with and in strict compliance to the complete contract specifications and drawings.

B. A single Electronics Systems Contractor (ESC) having met all the requirements listed hereafter and having been approved by special addendum, shall assume control and accountability for furnishing and installing all systems as specified hereafter using only equipment of pre-approved manufacturers.

C. The ESC shall be responsible for the total integration and interfacing of the products and systems specified in this section and all other sections in accordance with submittals, which have been reviewed and approved by the Architect and or Consultant.

D. The ESC must maintain a fully staffed office owned and operated by the ESC and under the same name. The office must have and maintain permanent employees under it's hire for positions of project management and trained electronics technicians sufficient to provide the proper service to the defined project throughout the warranty period and a minimum of one (1) year following the warranty period.

E. Response time to a service/warranty call shall not exceed twenty-four (24) hours in a normal situation or four (4) hours in an emergency situation. Warranty service must be available through a toll-free number to the Owner, twenty-four (24) hours a day and seven (7) days a week.

F. Related Sections:
   1. Detention Equipment
   2. Door Hardware
   3. Sections 260000 Electrical
   4. Sections 270000 Telecommunications

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)
   1. UL 508 Industrial Control Equipment
   2. NEC National Electrical Code (latest edition)

D. Institute of Electronic and Electrical Engineers (IEEE)
   IEEE 802.3 CSMA/CD (ETHERNET)

1.03 SCOPE AND RESPONSIBILITY

A. The scope of work and project responsibility shall consist of the total content of any and all portions of the contract document drawings and specifications. The scope of work shall generally include but not be limited to the following outline of major project requirements and responsibilities.
B. The ESC scope of work shall consist of, but not be limited to the following as defined in the details of this division of the specifications and as shown on the plans.
   1. Security Electronics, General
   2. Touch Screen System
   3. Programmable Logic Controller
   4. Electronic Relay System
   5. Intercom System
   6. IP Closed Circuit Television System
   7. Watch Tour System
   8. Vehicle Detection
   9. Uninterruptible Power Supply (UPS)
   10. Surge Protection
   11. Fire Alarm System
   12. Grounding and Bonding
   13. Telecommunications – Specification sections 270000 thru 272133.
C. The ESC scope of work shall additionally consist of the following:
   1. Raceway and conduit system: The Division 26 Electrical Contractor shall furnish and install a complete conduit and raceway system including all necessary conduit, back boxes, wire ways, pull strings, pull/junction boxes, fittings, straps, access panels and connectors for a complete raceway system for all work contained within this section. Each system requires an independent raceway and conduit system. The Division 26 contractor shall install the raceway and conduits systems per applicable Sections of the Division 260000 specifications and the latest revision of the National Electrical Code as applicable at the time of contract award. The ESC shall create complete conduit plans and details for review and approval.
   2. Furnishing, installing (pulling) and terminating of all wire, wiring and cable.
   3. The ESC contractor shall be responsible for furnishing and installing all equipment, wiring, installation and testing of systems defined in Division 28. **The sub-contracting of Division 28 equipment installation shall not be acceptable.** The Division 28 contractor shall be responsible for the design, fabrication, project management, installation and warranty of all systems within this division of work.
   4. The security system shall be on an autonomous network and shall be completely isolated from the internet.
   5. Complete engineering documents consisting of conduit plans, equipment plans, cut sheets and manuals for a coordinated total system including documentation for submittal, installation, operation and maintenance.
   6. Project management on and off site to oversee and supervise all work performed by, for or in coordination with the scope of work by the ESC. Inspection and verification of the site and building prior to installation to insure correctness of structure.
   7. Although such work may not be specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a complete and operating system.
   8. Furnish and install all necessary power transformation and surge protection required to operate control system equipment and functions.
   9. The plans and specifications show and or specify a conduit and raceway system to be provided by the Division 26 contractor under the requirements of the NEC and Division 260000 requirements. It is the responsibility of the ESC to review the plans and specifications to insure that the requirements adequately cover the requirements of this division, if not the

ESC shall be responsible to notify the Architect concerning the deficiencies of the bid documents. Any additional requirements for conduit and raceways beyond that shown and or specified that are a result of the ESC changing or utilizing a system or design different from that shown and specified, then the ESC shall be responsible for any additional requirements for conduit and raceways beyond that shown and or specified. All installations shall be in strict accordance and compliance with the NEC and Division 260000.

D. Related work specified in other divisions with the work being furnished and installed as a responsibility of the specified division.
   1. Site work including any trenching if and as applicable.
   2. Concrete work including bases and anchor bolts for units such as exterior intercom pedestals and camera poles.
   3. Casework and millwork except as specified herein.
   4. Electrical work except as specified herein.
   5. Control work and/or annunciation except as specified herein.
   6. All power and branch circuits including raceways, conduit, wiring and terminations from power distribution panels to terminal strips and/or receptacles in electronic control cabinets/panels and/or at electronic system devices. All distribution circuits shall be connected to the emergency power source.
   7. Painting and touch up.
   8. Patching of concrete, tile and masonry.
   9. All caulking and sealants.
   10. Final cleaning.
   11. Firesafing.

E. Related work in other divisions that requires close coordination of this division.
   1. Lighting, utility and receptacle control relays will be provided by this section. The conduit, wiring and terminations for the high voltage lighting, receptacle and all utility control wiring will be as furnished and specified in and by Division 26.
   2. The conduit system for the control equipment must be closely coordinated between Division 26 and Division 28 specifications.
   3. The control equipment requires power at the following locations:
      a. All control panel and touch screen locations.
      b. All relay cabinet locations.
      c. All camera, intercom, access control and equipment cabinet locations.
      d. All IPCCTV monitor and control locations.
   4. Elevator, generator and water flow controls must be closely coordinated with Division 26 and 15 requirements to ensure requirements have been placed in each of the individual effected specifications to allow for proper control.
   5. Roll Up Doors and Gates.

F. Acceptable ESC's
   1. Icotech, Montgomery AL
   2. Valdosta Technical Systems, Valdosta, GA
   3. Southern Steel, San Antonio, TX
   4. Cornerstone Detention, Tanner, AL
   5. Accurate Controls, Ripon, WI
   6. Stanley Security, TX
   7. SWC – SouthWestern Communications, Inc., Decatur, AL

1.04 PREQUALIFICATION REQUIREMENTS

A. All ESC's must be pre-approved and listed. ESC's not listed as being approved that desire to bid the project must request approval and shall submit the following qualification information to the

Architect in writing no later than fourteen (14) days prior to bid. Request received after this time will not be considered under any condition. If approval is received, acknowledgment will be by the noted special addendum. Verbal approval will not satisfy the right to bid. The ESC shall be named and listed on the bid form. Any bid forms containing the name of any ESC not listed and pre-qualified will not be considered and will be thrown out as a non-qualifying bid. All ESC's shall submit all information exactly as herein requested or approval will not be considered. Disqualification shall immediately exist if the request is submitted in a manner inconsistent and or incomplete as requested following. Disqualification shall also exist if in the opinion of the Architect and or Consultant, the information submitted is inaccurate or does not satisfy the qualification requirements.

B. The Architect / Consultant reserve the right to disqualify and or not approve any ESC for any reason if they deem it to be in the best interest of the Owner.
C. The ESC shall be a true systems integrator specializing in the design, manufacture, installation and servicing of integrated security electronics and communication control systems.
D. The evaluation of each perspective ESC's qualifications will be strictly and solely based on the qualification proposal. The proposal's format must be on a paragraph-by-paragraph basis to the items listed following:
    1. Provide a history of the company that reflects accurately the length of time the company has been licensed and performed services of an ESC. The company shall have been in business under and incorporated under the name submitted in the proposal for a minimum of ten (10) years. For companies with multiple offices, the proposal must contain information based only on the location that will be responsible for the entire management and operations for this project from award of bid through the warranty period.
    2. ESC's shall be properly licensed by the State to perform this scope of work. Provide a copy of the Georgia Low Voltage Alarm Contractor License as required by the Georgia Construction Industry Licensing Board.
    3. Provide a complete company organizational chart to include the owner(s), officers and key individuals.
    4. Provide an organizational chart to include the names and positions of the Project Manager, Engineering Manager, the principal Project Engineer, the Project Programmer(s), the Manufacturing Manager, the Project Superintendent, the Lead Technician, all Field Technicians and Technical Support Staff that are to be assigned to this project.
    5. For each of the individuals listed in the organizational chart, provide complete resumes and a delineation of each individual's responsibilities for this project. The resumes must include information about the individual's education, electronics systems detention experience, systems integration capabilities, factory training and certification and the length of time employed by the ESC. Provide a copy of each individual's manufacturer's certificate of certification for all systems, equipment and software for which each individual that will be involved.
    6. The ESC must employ and provide the names and resumes of the following resident staff personnel in its employ and such individuals must have oversight of the project. The resumes shall include the same information as listed in paragraph 4 above plus a copy of the certificates of certification required for each:
        a. A Microsoft Certified Professional.
        b. A UL Trained Applications Engineer.
    7. Provide a list of the ten (10) most recently completed projects involving the major systems similar to those described in these specifications for which the ESC has been the integrator and having furnished and installed. Each project shall be of the size, complexity and requirements of this project and must have been in successful operation for a minimum period of three (3) years. If more than ten (10) projects are listed, only the first ten (10) will be reviewed. Provide the following information for each project:

a. Project name and location.
b. Date project was completed.
c. Total project value.
d. Contract amount to the ESC.
e. Names of the ESC's Project Manager, Principal Project Engineer and Field Superintendent.
f. Name and telephone number of Architect.
g. Name and number of the Security Consultant.
h. Name and number of the Architect's Project Manager and Site Project Engineer.
i. Name and number of an individual (preferably the maintenance manager) at each facility who is familiar with the operation, performance and maintenance of the facility's security electronic system. Reference must be current or the ESC will be considered non-responsive.
j. List and description of all systems on the project and the approximate value of each.

8. Provide a list of all projects, which the ESC was involved in any form of litigation. Provide the following information for each project:
   a. Project name and location.
   b. Date project was started or completed.
   c. Total project value.
   d. Contract amount to the ESC.
9. Provide a list of all projects, which the ESC was assessed liquidated damages, even those projects for which the ESC did not have to pay a claim. Provide the following information for each project:
   a. Project name and location.
   b. Date project was started.
   c. Total project value.
   d. Contract amount to the ESC.
10. Provide a current independently audited and certified financial statement showing a consolidated net worth of $1,000,000.00.
11. Provide a letter from the Surety Company reflecting the Surety Company's history with the ESC. The letter must state the position of the Surety relative to providing a 100% payment and performance bond should a contract be awarded to the ESC. The letter must be an original and include a current issue date and reference this project and state the estimated value of the ESC contract. Even though the ESC may be a subcontractor to the DEC, the ESC will be required to provide both a bid bond to bid and a performance and payment bond in order to perform the work.
12. Provide Microsoft certificate and Microsoft qualification number attesting to the ESC's approval and certification by Microsoft that they are a Microsoft listed and authorized Microsoft Certified Professional.
13. Provide BICSI certificate and BICSI qualification attesting to the ESC's approval and that they are BICSI authorized.
14. The ESC shall confirm in writing that they will have qualified personnel available to be on the project site daily for any and all coordination purposes throughout the total duration of the project. Provide the names and resumes and the individuals.

E. Systems, equipment and products specified in this division shall be engineered, programmed, manufactured and assembled, installed and serviced by an approved ESC.

F. All work is to be performed in strict accordance to any and all applicable codes, ordinances, regulations and standards; Federal, state, local and otherwise including but limited to the following:
   1. National Electrical Code (NEC), latest edition
   2. National Fire Protection Association (NFPA)

3. Factory Mutual System (FM)
4. Electronics Institute of America (EIA)
5. Underwriters Laboratory (UL)

G. Provide a statement attesting that the ESC has reviewed the entire set of bid documents not just Division 28000 and understands the specified system and project requirements.

H. Provide a riser diagram for each system specific to this project depicting all relevant details and information inclusive of but not limited to equipment layout and locations, conduit routing and sizing, cable and wiring requirements and power requirements.

I. Provide for each system specified a delineation of the task required to be performed by the ESC. Provide technical proposals reflecting the ESC's experience in the field of scope.

J. Provide a narrative description of all software to be used including touch screen, programmable logic controllers, access control, systems management, closed circuit television and video visitation.

K. Provide from each manufacturer of each system certification that the ESC and its applicable personnel have been factory trained and certified to manufacture /assembly, install and service equipment contained in each system.

L. Refer to each individual section of this division of the specification for the list of acceptable manufacturers. If the ESC preparing the proposal desires to request a substitute, he must do so within the confines of these proposal qualification requirements in writing fourteen (14) days prior to the bid date. Manufacturers and equipment substitution proposal request must be submitted noting section, page, paragraph and item with a detailed cross-referencing and comparison. For proposed substitutions submit the following information exactly as requested:
   1. Name of manufacturer
   2. Address of manufacturer
   3. Phone number of manufacturer
   4. Trade name
   5. Model and catalog designation
   6. Performance and test data
   7. Referenced standards
   8. Warranties
   9. Material construction
   10. Finish

M. Electronic components shall be from manufacturers who at present have not less than ten (10) years continuous successful experience in the design and manufacture of the type products required for this project.

N. In order to meet the high standard requirements for Quality Assurance, proprietary and custom systems are not acceptable.

1.05 SUBMITTALS

A. General: Submit listed Submittals in accordance with Conditions of the General Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's data sheets for all proposed system components. Submit six (6) copies with all specific items that will be provided clearly indicated and the options highlighted. Submit product data in PDF electronic format.

C. Shop Drawings: Complete system Shop Drawings shall be prepared for this particular project which include device layout based on the building floor plan, point-to-point wiring diagram(s), conductor sizes and types, riser diagrams and schematics, theories of operation, full scale color Graphic Panel layout drawings, and full scale color Touch Screen map layouts. Submit six (6) copies for review and approval. Layout shall be based on an actual building floor plan provided by the Engineer as well as diagrammed for system clarity. Drawings shall show all equipment

locations and quantities required. A final "as-built" plan layout shall be provided to the Owner upon Substantial Completion of the actual installation.

D. Materials List: Submit a complete materials list indicating all equipment to be provided as part of this section.
E. Samples: Submit selection and verification samples of finishes, colors, and textures as requested.
F. Complete details of equipment mounting configuration.
G. Manufacturing assembly and testing procedures and forms.
H. Installation testing and check out procedures and forms to be used by the ESC and Architect and or Consultant.
I. The conduit plans, equipment plans, riser diagrams, block diagrams and details are to be submitted in the latest version of MicroStation or AutoCad and shall be submitted on a minimum of a 'D' size drawings in electronic PDF format. Documents submitted in any other manner including marked up sets of the bid documents shall receive immediate rejection and will not be reviewed. A complete set of as built documents will be issued at the completion of the project inclusive of CAD files on CD.
J. Submittals issued in a manner inconsistent with the requirements of these specifications shall receive immediate rejection and will not be reviewed. Submittals issued containing materials, products and or equipment not listed and approved addendum shall receive by the original bid document specifications or by immediate rejection and will not be reviewed.

1.06 OPERATION & MAINTENANCE MANUALS

A. The ESC shall furnish three (3) sets of operational and maintenance manuals for all systems furnished. The manuals shall include component list, instructions for care, operation instructions, instructions for ordering replacement equipment and personnel to contact for warranty work.
B. Record Documents:
   1. This Contractor shall supply Record Documents for the entire facility inclusive of existing areas (if applicable), systems and conditions. The as Record Documents at a minimum shall include floor plans, conduit plans, control room layouts, equipment room layouts, touch screen control layouts, equipment cabinet layouts (including existing to remain if applicable), theories of operation, wiring diagrams and schematic block diagrams.
   2. At the time of project completion, this contractor shall turn over to the owner all original software media and manuals for all programmable systems to include but not be limited to Touch Screen Computers, Programmable Logic Controllers, Access Control System, Intercommunications System and IP Closed Circuit Television System.
   3. At the time of project completion, all project installed hardware, software and programs becomes the sole property of the owner.

1.07 APPROVALS

A. Deviations from this specification must be documented in writing to the Architect and Engineer at least fourteen (14) business days prior to the bid date.
B. Complete catalogue data, product specifications, and technical information on alternative equipment must be provided including all associated cost savings or additions, including but not limited to equipment, equipment installation, power wiring and materials, programming, documentation, and project management.

1.08 DELIVERY & HANDLING

A. General: Comply with Division 1 Product Requirements Section.
B. Delivery: Deliver Materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials and equipment in an area protected from harmful weather conditions and at temperature conditions recommended by manufacturer. After initial installation, protect equipment from exposure to dust, dirt, paint, and other contaminants.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings.
B. Scheduling: Coordinate taking field measurements, fabrication schedule, and deliveries with construction progress schedule to avoid construction delays.

1.10 WARRANTY

A. Manufacturer's Warranty: All equipment and labor provided under this section is warranted for one (1) year from Substantial Completion or System Commissioning, whichever occurs first.
B. During the warranty period the ESC shall perform quarterly preventive maintenance inspections on all installed equipment.
C. Nothing in the above warranty shall apply to material which has been misused, abused as follows; neglect by the owner, defects or damage caused by work or failure of work by others, ordinary wear or normal equipment adjustment.
D. Additionally, any unauthorized modifications; repairs or tampering shall constitute termination of the warranty.

1.11 TRAINING

A. The ESC shall provide twenty (20) hours of on-site training for operational purposes and twenty (20) hours of training for maintenance purposes at the turn over of the project.
B. It is mandatory that the ESC shall set up in their facilities all equipment for the project and shall test each and every component and operation prior to shipping to the project. Test reports as mentioned above shall be provided to the Architect/Engineer.
C. The ESC shall include in their bid all expenses (travel, per diem, hotel and food) for up to six (6) operation officers and maintenance personnel to attend the factory testing of the systems for a maximum two (2) day period.

PART 2 - PRODUCTS

2.01 See Individual Division 28 Specification sections for specific product requirements.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280000 – June 17, 2024

SECTION 280100 - SCOPE OF WORK

PART 1 - GENERAL

1.01. SCOPE OF WORK

1. Provide touchscreen locking control replacement in the new housing units and existing facility with new PLC, headend equipment, relays, power supplies, etc. and new touchscreen locking control panels AT Master Control, intake, new housing unit control rooms, etc. and where shown on the drawings. Field verify all existing locking panel locations and security equipment cabinet locations.

2. Existing systems are as follows but not limited to:
   a. Touchscreen Locking Controls
   b. Intercom and paging
   c. IPCCTV cameras
   d. Watchtour
   e. Access Control
   f. Fire Alarm
   g. Low Voltage Systems, Voice, Data, Television, WIFI

3. Provide an intercom system that communicates from Master Control to all control rooms and to all touchscreen units. The intercoms shall be capable of calling from each touchscreen unit to central control. The central control master intercom unit shall have an "ALL CALL" switch to all call every touchscreen intercom master.

4. Provide a new IP CCTV camera system in the new facility. Provide new headend equipment for all existing cameras and new cameras at the existing Master Control area and new housing units as required.

5. Provide a new fire alarm system.

6. Provide new security equipment cabinets including, but not limited to PLC's, I/O cards, CPU's, UPS units, cabinets, switches, relays, terminal strips, power supplies, fuses, led's, intercom headend, camea headend, etc.

7. Provide new WIFI system for the new housing unit and entire facility.

8. Provide Site Fiber Optic cabling. Provide new fiber optic cabling for the new housing unit and extend to the existing areas. If existing fiber location is not at the same location as the new security equipment cabinets, then this contractor shall provide all material and labor to make the connection. New fiber optic cabling shall be required for the new housing units.

9. Any medico locks for UPS/touchscreen PC cabinets, security equipment cabinets, cabinets, etc. shall have a new key code.

10. Test, adjust and commission the new touchscreen locking control system, new wiring, locks, door position switches, call-in switches, intercoms, duress switches, watch tour devices, etc.

11. The UPS system shall be sized for one (1) hour of operation. All existing UPS units shall be replaced with new. New UPS units shall be required in the new housing units.

12. All new components in these specifications shall be UL listed.

END OF SECTION – June 17, 2024

SECTION 280120 - TOUCH SCREEN SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Touch Screen control stations as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional control system.

B. Related Sections:

1. Section 11190 Detention Equipment
2. Section 08710 Door Hardware
3. Section 260000 Electrical
4. Section 280000 Security Electronics, General
5. Section 280140 Programmable Logic Controllers
6. Section 280150 Electronic Relay System
7. Section 280200 Intercommunications System
8. Section 280300 Closed Circuit Television System

1.02 ACCEPTABLE INTEGRATORS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following manufacturers:

1. Icotech, Montgomery AL
2. Valdosta Technical Systems, Valdosta, GA
3. Southern Steel, San Antonio, TX
4. Cornerstone Detention, Tanner, AL
5. Accurate Controls, Ripon, WI
6. Stanley Security, TX
7. SWC – SouthWestern Communications, Inc., Decatur, AL

1.03 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.04 WORK INCLUDED

A. Provide materials, labor, equipment, and services necessary to furnish, deliver, and install a touch screen control system as shown on the drawings, as specified herein, and/or as required by job conditions.

B. Major Sub-systems include:

1. Touch Screen Control Stations.

2. Programmable Logic Controllers (PLC's).
3. Electronic relay system.

1.05 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the work of this Section with that of other Sections as required ensuring that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

B. Coordinate with specific hardware provided by contractors for builders hardware and security hardware.

C. Division 28 responsibilities for electro-mechanical locks and devices Shall include the following:
   1. Division 28 shall provide relay cabinets in each equipment room as shown on the drawings to interface to the door locks, door status switches, and jam mounted push-buttons and key switches. Relay cabinet and associated terminal strips shall be sized as required to accommodate control equipment for specified lock functions.
   2. Division 28 contractor shall be responsible for furnishing and installing all equipment, wiring, installation and testing of systems defined in Division 28. The sub-contracting of Division 28 equipment installation shall not be acceptable. The Division 28 contractor shall be responsible for the design, fabrication, project management, installation and warranty of all systems within this division of work.
   3. Provide all control hardware and systems to control or monitor a door in accordance with the requirements of Division 28 and the wiring diagrams provided by Division 8 and Division 11.
   4. For doors which include hardware furnished and installed by the Division 8 Contractor and requires Division 28 devices and functional control such as doors equipped with card readers intercoms, push buttons, and other control devices; the Division 28 Contractor shall furnish and install conductors, and cabling systems to support all door functions.
   5. After installation, verify proper control operation of all doors.
   6. Division 28 shall be responsible for coordination of all interfaces with Division 16 for any lighting or power controls interface that may be required from the Division 28 control Systems.
   7. Division 28 shall be responsible for coordinating with Division 16 the exact locations and requirements for electrical power provided to the security equipments.
   8. Division 28 shall be responsible for ensuring that all security system equipment is powered from an emergency power panel and that all Division 28 systems, except where otherwise noted, are powered from an uninterruptible power system (UPS).

D. Division 11 responsibilities for electro-mechanical locks and devices shall include the following:
   1. Furnish and install door locks, door position switches, limit switches, lock feature switches and push buttons and key switches, as required for the system to perform the functions as defined herein.
   2. Division 11 furnished and installed hardware shall be installed and prepped complete including lock and switch pigtails being stripped and ready for termination by the Division 28 contractor.
   3. Furnish wiring drawings and other information as required for design and installation of the control drawings.
   4. Solenoids for direct current (DC) application shall be equipped with diodes for transient protection.
   5. After installation, adjust all locks and switches for proper indication and mechanical alignment.
   6. Hollow metal frames shall be provided with boxes or pockets as required to accommodate door position switches, locks, key switches and/or push buttons.

7. Hollow metal frames shall have provided interconnecting conduit between the door position switch and the lock pocket and a conduit stubbed from the lock pocket to the top and/or bottom of the frame. Conduits shall have a pull string installed.

E. Division 8 responsibilities for electro-mechanical locks and devices may include the following, but not limited to: Coordinate with the hardware contractor/supplier for all requirements:
1. Furnish and install door locks, door position switches, limit switches, lock feature switches and push buttons and key switches, as required for the system to perform the functions as defined herein.
2. Division 8 furnished and installed hardware shall be installed and prepped complete including lock and switch pigtails being stripped and ready for termination by the Division 28 contractor.
3. Furnish wiring drawings and other information as required for design and installation of the control drawings.
4. Solenoids for direct current (DC) application shall be equipped with diodes for transient protection.
5. After installation, adjust all locks and switches for proper indication and mechanical alignment.
6. Hollow metal frames shall be provided with boxes or pockets as required to accommodate door position switches, locks, key switches and/or push buttons.
7. Hollow metal frames shall have provided interconnecting conduit between the door position switch and the lock pocket and a conduit stubbed from the lock pocket to the top and/or bottom of the frame. Conduits shall have a pull string installed.

1.06 SUBMITTALS

A. General
1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:
1. Submit catalog cuts for all equipment and devices being furnished under this Section.
2. Submit full scale color drawings for each control screen which shall designate colors and icons for each controlled and/or monitored condition within the system.
3. Submit electronic files from which each screen may be viewed to reflect selected colors and icons. Software shall be provided to allow the Engineer and Owner to view the screens.

C. Software development
1. Within one (1) month of receiving the approved shop drawing submittal, the security equipment contractor shall schedule a preliminary meeting with the owner and architect/engineer. Specific operation and function of the security control system must be determined prior to the preliminary meeting. Extensive analysis outlining all performance of software design and application will be determined and approved at the preliminary meeting.
2. Based on the preliminary meeting, the Division 28 contractor shall develop the control and display software. The complete set of control screens shall be submitted as shop drawings on both paper prints and electronic CAD files. If necessary, shop drawings shall be resubmitted until approved.
3. Any changes or modifications to the system resulting from the shop drawings shall be incorporated into the system and demonstrated at a meeting to finalize the system.
4. Any modifications to the system resulting from the meeting will be incorporated and demonstrated at the factory testing.

D. Factory Testing
1. The Division 28 Contractor shall bear the cost of travel and subsistence for four (4) operation officers and two (2) maintenance personnel to witness factory testing of the touch screen

control and monitoring system assembled in the factory. The contractor shall give written notice that the system is ready to be tested a minimum of 14 days prior to testing, and testing should occur approximately 4 months prior to the scheduled completion date for the project.

1.07 TOUCH SCREEN SYSTEM DESCRIPTION

A. Touch Screen control stations provide the human interface device at locations as shown on the drawings for security alarm monitoring and control of security devices including doors, cameras, and intercoms.

B. The Touch Screen control stations are comprised of a Pentium based PC, LCD monitor with touch screen transducer. The control icons serve as a means of interface to the programmable logic controller (PLC). The PLC then performs logic functions (such as timing and interlocking) and activates the appropriate field devices (such as locks or video Switcher control) based on the graphic control panel switch command.

C. Monitoring functions: The PLC receives signals from field devices and routes the information to the Touch Screen control stations where icons and/or audible tones annunciate the condition of the controlled field devices.

D. The touch screen terminal consists of a 32" high-resolution LCD color video monitor integrated with a touch screen transducer which is applied to the monitor surface. Touch screens shall be freestanding or rack mounted in casework as indicated on the drawings. Freestanding monitors shall have adjustable swivel bases secured to the casework.

E. Log-In: Access to the touch screen system shall be password protected and all operators shall log into the system. Touch screen keypads shall utilize a "scramble" function so that the digits do not appear in the same location each time an operator logs into the system. All log-in/log-out activities shall be recorded on the system data logger. Terminals shall be limited to three consecutive invalid log-in attempts. After three failed attempts, the terminal shall be disabled and an alarm shall be generated at Central Control. Control of the screen must be returned from Central Control.

F. Mouse: Each touch screen station shall also be equipped with a mouse to operate the terminal using an on-screen indicator rather by using the touch of a finger. Selecting a program segment or option requires moving the display cursor to the appropriate screen location with the mouse and depressing left mouse button.

G. Control Transfer: Two methods of control/transfer shall be provided:

1. Substation Transfer. Activating the "Log Off" icon on the touch screen monitors shall automatically transfer all control and indicating functions to the designated location. When logged off, the transferred terminal shall not be capable of performing control functions. Return to normal operation shall be accomplished by logging onto the system using the video keypad.
2. Control "Takeover": Activating the "Takeover" icon on the touch screen monitor shall automatically transfer all control and indicating functions to the designated location. When logged off, the transferred terminal shall not be capable of performing control functions. Return to normal operation shall be accomplished by logging onto the system using the on-screen keypad.

H. Takeover Hierarchy: Central Control shall be able to take over any control location.

I. UPS Alarms: UPS Alarms shall send a text message to Central Control and be logged on the data logger.

J. Failure of any touch screen or network PC shall not affect the operation of any other touch screen station. Touch screen control stations shall communicate directly with the PLC's for control functions via the security Ethernet LAN. PLC's shall be located in equipment rooms as shown on the drawings.

K. Each Touch Screen control station shall contain a licensed copy of the Graphical User Interface Software (GUI). The use of server based systems shall be strictly prohibited. All copies of

licenses shall be turned over to the owner at the time of substantial completion of the project and become the sole property of the owner.

L. The system shall utilize voice instructions for alerting the operator to alarm conditions and critical control sequences such as interlock, interlock override, emergency release, and other functions as directed by the Owner/User. There shall also be a voice annunciation ON/OFF switch to enable and disable the voice instructions.

1.08 TOUCHSCREEN SYSTEM – SCREEN CONTROLS/MONITORING FUNCTIONS – GENERAL:

A. General: Control screens shall be comprised of icons and text fields. Icons shall designate the sensitive area for touch control and display, which provides a pictorial representation of a switch function.
   1. All icon activations shall be annunciated with an audible tone, a color change of the icon, and a change of icon configuration.
   2. Each screen shall annunciate off-screen inputs, such as intercom calls and alarm events. The control terminal operator shall be notified of these events regardless of the screen that is currently displayed on the terminal.

1.09 TOUCHSCREEN SYSTEM – SCREEN CONTROLS/MONITORING FUNCTIONS - SPECIFIC

A. Specific Icon Control Functions: The drawings include representative control and monitoring screens for several console locations. Following is a description of the control and monitoring functions for the icons presented on those drawings. The following descriptions may not include all control and monitoring functions for all icon types required for this project, but provides a representative sample to indicate the type and level of control and monitoring expected.

B. Door Control and Monitoring
   1. SWING DOOR. Momentarily touching the Unlock icon shall apply power for approximately one second to the lock motor, to begin it's unlocking cycle. A GRAY padlock shown locked indicates SECURE condition of the door. A RED padlock shown unlocked indicates UNLOCKED or UNSECURED condition of the door. If door is part of an INTERLOCK GROUP, the icon outline shall become yellow anytime another door in the group is unlocked. An attempt to unlock a door that is part of an interlock group (while another door of the interlock group is insecure) shall cause a dialogue box to be displayed indicating the presence of an interlock. The dialogue box shall include icons for OVERRIDE or CANCEL. Touching the OVERRIDE icon shall defeat the interlock and unlock the selected door. Touching the CANCEL icon shall cancel the dialogue box and return to the floor plan.
   2. MONITORED ONLY DOOR: A GRAY padlock shown locked indicates SECURE condition of the door. A RED padlock shown unlocked indicates UNLOCKED or UNSECURED condition of the door.
   3. FULLY OPERABLE SLIDING DOOR DEVICE: Open/Stop/Close. Momentarily touching the Open icon shall open the door. Momentarily touching the Stop icon shall halt any door movement. Momentarily touching the Close icon shall close the door. The device shall not be allowed to reverse operation without first going through an approximate one second delay of stop time. If the door is part of an interlock group and another door in the group is not secure, the door will not open without overriding the interlock group. A GRAY padlock shown locked indicates SECURE condition of the door. A RED padlock shown unlocked indicates UNLOCKED or UNSECURED condition of the door. If door is part of an INTERLOCK GROUP, the icon outline shall become yellow anytime another door in the group is unlocked. An attempt to unlock a door that is part of an interlock group (while another door of the interlock group is insecure) shall cause a dialogue box to be displayed indicating the presence of an interlock. The dialogue box shall include icons for OVERRIDE or CANCEL. Touching the OVERRIDE icon shall defeat the interlock and unlock the selected door. Touching the CANCEL icon shall cancel the dialogue box and return to the floor plan.

4. ROLL UP DOOR, SLIDING VEHICLE GATE: See description for fully operable sliding door device.
5. INTERLOCK OVERRIDE: This function shall be accomplished utilizing an interlock dialogue box. The dialogue box contains two icons, Override and Cancel. When an attempt to unlock or open a door within an Interlocked group of doors where one or more doors are in the insecure position, the Interlock dialogue box shall appear. Selecting the Override icon will allow the opening of the door. Selecting the Cancel icon will return the operator to the previous control screen. When a door is part of an Interlock group and another door within the group is insecure, the outline of the padlock door indication symbol shall illuminate yellow for all doors within the group. Once the door moves to the insecure position, the fill color of the icon shall turn red and depict an unlocked padlock symbol while the outline is simultaneously yellow.
6. GROUP ASSIGN: There shall be a Group Assign toggle function. Once the Group Assign toggle function has been activated, touching any door icon within the associated group will assign the door to be released upon activation of the Group Release function. If a door has been selected for the Group Assign function the door indication icon shall have its keyhole circle change from black to blue in color to indicate the Group status of the door. Depressing the Group Assign toggle function a second time will disable the function and return the system to its previous operating condition.
7. GROUP RELEASE: Touching the Group Release icon shall cause all doors within the group that have been previously assigned to unlock and the door status icons for each doorway will indicate the actual status of the doors. All doors connected to the group shall re-lock when closed.
8. EMERGENCY RELEASE:
    a. Touching the “Emergency Release” icon located in the menu bar of the Touch screen shall switch the view to the primary emergency release screen, which shall contain an Emergency Release icon for each ER group within the facility and an ER Enable icon. Touching the Enable” icon shall arm the system for emergency release and shall display an “Are you Sure?” prompt and “Yes” and “No” icons. Touching the “No” icon shall again display the primary emergency release screen. After touching the “Yes” icon, a pulsing audible tone shall sound every 4 seconds to indicate the system is armed.
    b. While armed, touching a Emergency Release icon for any ER Group, an emergency Release door switch, or a normally controlled door release switch shall unlock the door or doors associated with that switch and the doors shall remain unlocked until reset. A “ER Reset” icon shall appear on each screen. Touching the “ER reset” icon and then an activated door or Emergency Release icon shall reset the emergency release function for that door or group and the door(s) shall lock.
    c. The emergency release function shall continue to be armed and the audible tone shall continue to sound until the operator returns to the primary emergency release screen and touches the emergency release “Cancel” switch. The “Cancel” switch shall disarm the emergency release function, cancel the audible tone, and reset and lock all doors opened by the emergency release function.
    d. The door indication icon for doors actively Emergency Released shall have it’s black keyhole change to a flashing black “E”. Once the Emergency Release has been reset, the “E” shall change back to a keyhole and the icon shall depict the current status of the door as previously described.
9. INTERCOM CONTROL: When an intercom call-in is initiated from a sub-station the following conditions shall apply:
    a. The intercom station icon shall have a speaker symbol that will flash green to indicate the call-in along with an audible tone every 4 seconds. Touching the intercom station icon will select the audio path to the station and cause the icon speaker symbol to change to

steady and green. Touching the station icon a second time, or selecting another intercom station, will cause the audio path to be closed and the speaker symbol to turn gray in color to indicate the inactive status of the station.

b. Once an intercom station is active, the operator shall touch and hold the Push To Talk icon to talk to the associated intercom station, and release the Push To Talk icon to listen to the associated intercom station.

c. Intercom call-ins shall go into an intercom stack on a first in first out basis. Located in the menu bar shall be two intercom associated icons, “Select” and “Reset”. Touching the Select icon will select the first Intercom call-in within the stack and automatically change the control screen to the location of that Intercom icon. Each time the Select icon is touched the current intercom conversation will be terminated and the next call in the stack will be initiated and the appropriate graphic control screen will be called. Touching the “Reset” icon will cancel any current intercom station. Intercom stations are NOT to be displayed in the alarm queue of the Touch Screen control station.

d. Anytime an intercom station is active, the associated camera/cameras are to be displayed on the associated video segments. Video segment 2 is to display the camera viewing the side of the door where the intercom station is active. Video segment 3 is to display the camera viewing the opposite side of the door.

10. INTERCOM ISOLATE: The Touch Screen shall allow cell intercom stations and/or any other station as directed by the Architect/Owner to be placed in to an isolated state.
    a. There shall be an Intercom Isolate icon located in the menu area of the Touch Screen. Selecting the Isolate icon will activate the Isolate Mode and the Isolate icon background shall turn green in color to indicate the active status.
    b. While the system is in the Isolate Mode, touching an Intercom Station icon will put the associated station in an isolate state. Each intercom station in an isolated state shall be indicated by a diagonal yellow line through the associated station icon.
    c. While an intercom has been isolated, the audible message will not be played at the operator station when a remote intercom station places a call. The operator shall still be able to select the intercom station for communications.
    d. The isolated intercom will automatically cancel after activation as determined by a user adjustable timer. The operator can reinstate the isolate function by repeating the initial steps.
11. PAGING SPEAKER/ZONE: Touching a PAGE icon shall select a paging speaker zone for broadcast. Touching the PAGE icon a second time to reset. The associated Page icon shall have a speaker symbol that will turn green in color any time the page function is active. The speaker symbol shall be gray in color to indicate the inactive status of the Page The operator shall press and maintain pressure on the Push To Talk switch to talk in order to broadcast out to the affected speakers.
12. ALARM QUEUE: Located at the bottom of each control screen shall be an alarm queue. This queue will display a list of alarms in the order at which they were initiated.
    a. Each alarm shall be depicted in the queue by a text description as well as audibly annunciated with a voice command describing the alarm condition. Voice commands shall re-sound every 4 seconds until the alarm condition has been acknowledged and reset.
    b. The alarm condition shall be acknowledged by highlighting the condition in the queue and touching the “Select” icon. This sequence will cause the appropriate control screen to be automatically displayed and display an alarm dialogue box with operator instructions for the alarm condition response.
13. ALARM SILENCE: Touching the Alarm Silence icon shall cause the audible alarm to silence. All visible indicators shall remain unaffected.

14. ALARM RESET: Touching the Alarm Reset icon will return all acknowledged alarm conditions to their normal state, and extinguish any alarm icons only after the alarm signal has been cleared.
15. CCTV CAMERA CONTROL: CCTV camera icons shall have a camera symbol located within the camera control icon. While a camera is inactive the camera symbol shall be gray. Touching the camera control icon shall display the camera to the appropriate on-screen video segment and cause the camera symbol to turn orange. Touching the camera control icon a second time will cause the associated on-screen video segment to go blank and return the camera symbol to gray to indicate the inactive status of the camera. If a camera is automatically called-up for an intercom call, the above described icon conditions shall apply for any active cameras.
    a. There shall be four (4) individual video segments imbedded in the Touch Screen display. Video shall be streamed to each display directly from the digital video network. The use of analog video capture cards to accomplish this function shall not be allowed. Video segments shall be as described below:
        1) Segment 1 – Shall serve as a spot monitor that reacts to camera selection via on-screen camera icons.
        2) Segment 2 – Shall serve as an Intercom Active monitor. Each camera that is associated with a particular intercom shall be called to this video segment upon selection of the station.
        3) Segment 3 – Shall serve as an Intercom Opposite monitor. For each Intercom/Camera association where there is a camera view available for the opposite side of the associated door, the camera view for the opposite side of the door shall have the camera view displayed in this video segment simultaneously with the active intercom.
        4) Segment 4 – Shall serve as an Alarm Video segment. Any video associated with an alarm condition shall be displayed in this video segment.
16. WATCH TOUR:
    a. START: Momentarily depressing the Guard Tour START icon shall activate the Guard Tour System and the icon shall indicate the “active” status of the system. The icon for each remote Guard Tour Station graphically located on the control screens shall illuminate steady when the Guard Tour has been started and each shall extinguish one at a time as each station key-switch has been turned.
    b. COMPLETE: After the guard has checked into all remote watch tour stations, he must return to the control panel where the tour was started from and touch the Guard Tour COMPLETE icon, which will indicate the completion of the tour. (The Complete switch represents the last station in the tour).
    c. RESET: Touching the RESET switch can end the active tour only before the first station key-switch has been turned, after the first station has been checked, the tour must be completed.
    d. If the Guard Tour Stations are activated out of sequence or not activated in the specified allotted time, then all illuminated station icons will flash with an audible tone sounding at the control station.
    e. The COMPLETE icon is inoperable until the last Guard Tour station has been checked, then the COMPLETE icon is operational and will act as the last station in the tour.
    f. The following events shall be recorded in the SMS database:
        1) Start Guard Tour: “Guard Tour started at current time”
        2) Allotted time expired: “Guard Tour ended before completing – current time”
        3) Out of Sequence: “Guard Tour activated out of sequence – current time”
        4) Completed: “Guard Tour completed – current time”

17. EMERGENCY POWER: The Emergency Power icon shall flash and an audible tone shall sound when the system is operating on power derived from the UPS System. This shall be an alarm condition that is annunciated in the alarm queue. While operating on Emergency Power the Alarm Silence icon can be touched to silence the audible tone and cause the icon to illuminate steady. The associated icon shall extinguish when the system resumes operating on normal power.
18. UTILITY POWER CONTROL: Touching any of the Utility icons shall either turn on or turn off the associated utility. The associated indication icon shall be illuminated when the utility is on and shall extinguish when off.
    a. The utilities are defined as:
        1) PHONE: Inmate telephones located in the housing dayrooms. (off = telephones not operable)
        2) TV: Television power outlet located adjacent to the TV. (off = power is not present at TV)
        3) WATER: Water valves controlling water to inmate cells. (off = running water is not available)
        4) DAY: Light fixtures in Housing dayrooms are controlled on/off.
        5) NIGHT: Night light fixtures in the cells are controlled on/off.
        6) CELLS: Main cell light fixture is controlled on/off.
        7) VIDEO VISITATION: on/off
        8) DAYROOM POWER: on/off
        9) COMMISARY POWER: on/off
19. PANEL DISABLE: Pressing the panel disable icon will disable the control station and initiate an alarm at the Central Control touch screen. The station can be enabled only from the touch screen control station or master graphic control panel having control of the area. While disabled, the screen shall be blank and display “Panel Disabled”.
20. PANEL CONTROL: There shall be a screen that is called from the Touch Screen utility screen that shall have an icon for each Control Station/Graphic Panel in the system. The icon shall indicate the Enabled/Disable condition of each control location. This function is only available to the Master Control station located in Central Control. Each control station may be enabled/disabled from these control icons.
21. CONTROL TRANSFER/LOG-OFF: Touching the “LOG OFF” icon will switch control of all panel functions to the designated transfer control station and cause the“LOG-IN” screen to be displayed. Control can be returned to the panel by entering a valid log-in code; no action is required by the station to which the panel was transferred.
22. MAIN SCREEN: Touching this icon will switch the display to an overall map of the facility. This control screen shall contain icons that will direct the operator to control screens for the various areas of the facility.
23. AREA ICONS: Located under a screen from the Utilities screen shall be icons for control of each area of the facility. These icons shall determine which control station has authority to control each area of the facility.
24. POST IT: information icon to input inmate information. One per cell, minimum.
25. CELL LOCKDOWN: provide icon to lock out any individual cell from the GROUP release. Not applicable on EMERGENCY RELEASE functions.

1.10 TOUCHSCREEN SYSTEM ALARM REPORTING FUNCTIONS

A. The following alarms shall be reported on the Central Control touch screen terminals and logged on the SMS computer:
    1. Unauthorized exit (opening) of any door monitored/controlled by the operator terminal or any station transferred to operator position.
    2. “Panel Disable” alarms from any control station.
    3. Duress Alarms

4. UPS Alarms
5. Interlock Overrides
6. Emergency Release

1.11 SECURITY MANAGEMENT SYSTEM DESCRIPTION

A. A Security Management System (SMS) shall be furnished and Installed and include the following interface terminals and equipment:
   1. Operator Terminals
   2. Printers
   3. File Server
   4. SMS components shall be interconnected utilizing a dedicated local area network (LAN)
B. The system shall:
   1. Provide a means of archiving alarm and other activity data in a SQL Server compatible data base.
   2. Provide packaged data reporting programs to generate activity reports based on user selectable search criteria. All reports shall be displayed in chronological order.
   3. Allow the user to create custom programs to retrieve data from the data base.
C. The Security Management System shall be served by the Ethernet LAN network. The file server/data logger shall retrieve data from the Touch screen operator terminals, card access system, and PLC's. The system shall be configured such that system malfunctions of the SMS cannot in any way affect the performance of the PLC and touch screen systems.
D. As the touch screen terminal or PLC receives or generates data, the data shall be copied to the Security Management System.
E. In the event the Security Management System is incapable of receiving data from the remote terminal, the remote terminal shall store the last 200 alarm records and transfer the records when the SMS is again functional.
F. Logging: System shall log all control and alarm events in the facility, including door control, and operator log-on and log-off activities.
G. The administrative Terminal located in Central Control shall be configured to access the database and activity reports.

PART 2 - PRODUCTS

2.01 Acceptable Integrators

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following manufacturers, subject to compliance with specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this Specification. Proprietary and custom systems are not acceptable.
   1. Icotech Inc. Montgomery AL
   2. Valdosta Technical Systems, Valdosta, GA
   3. Southern Steel, San Antonio, TX
   4. Cornerstone Detention, Tanner, AL
   5. Accurate Controls, Ripon, WI
   6. Stanley Security, TX
   7. SWC – SouthWestern Communications, Inc., Decatur, AL

2.02 TOUCH SCREEN SYSTEM

A. Graphical User Interface Software: The touch screen software shall have the following characteristics:
   1. Non-proprietary, standard, off-the-shelf product of a company other than the Division 28 Contractor.

2. Nationally distributed.
3. National software technical support.
4. Based upon a Microsoft Windows (latest version) operating system.
5. Provided with documentation to allow User Programming.
6. Software shall be Wonderware Intouch, GE Fanuc Cimplicity, or pre-approved equal.

B. LCD Monitor and Transducer: The touch screen monitor shall have the following characteristics:
1. Useful screen area: 27.48" Horizontal, 15.51" Vertical.
2. Display size: 32" diagonal.
3. Optimal resolution: 1366 X 768.
4. Colors: 16.7 million (8 bit).
5. LCD Panel brightness: 400 nits.
6. Response time: 8 msec (typical).
7. Viewing angle: Horizontal 178° total, Vertical 178° total.
8. Contrast Ratio: 3500:1 (typical).
9. Input Audio: Computer audio on 3.5mm stereo mini.
10. Input Data: Serial or USB 1.1.
11. Power Dissipation: 69 W (typical).
12. Temperature: Operating 0oC to 40oC, Storage -20oC to 60oC.
13. Speakers: Two built-in, 7W speakers in display head.
14. Mounting Options: 400 mm x 200 mm Vesa mount, desk top mount.
15. Monitor shall be Elo Touch Systems 3220L or pre-approved equal.

C. Touch Screen Computer
1. Intel® Core i7-7700 Processor (Quad Core, 3.6GHz, 8MB Cache).
2. Windows® 10 Professional 64 Bit.
3. 8GB, DDR4 Memory, 2400MHz.
4. 1GB video graphics card.
5. 500 GB, 7200 RPM hard drive.
6. 16XDVD+/-RW drive.
7. 10/100/1000 Gigabit PCI Ethernet adapter.
8. USB keyboard.
9. Optical USB mouse.
10. Digital PCI sound card.
11. Shall be powered by UPS.
12. CPU shall be located in a lockable metal enclosure.
13. The operation of the touch screen shall not depend on a keyboard. The keyboard shall be stowed and shall not be normally accessible from the console surface except as required for installation and maintenance purposes.
14. Acceptable PC manufacturers
    a. Lenovo
    b. Dell
    c. Hewlett Packard
15. Touch screen Spare Unit: The Contractor shall provide to the Owner a complete touch screen spare unit. The unit shall include a 32" color touch screen, CPU, mouse, operational programs and a licensed copy of the VGUI software.

D. Network Switches
1. Ethernet switch shall be IEEE 802.3 compliant and based on a modular design consisting of a main chassis and plug on modules. The switch will have the ability to utilize a variety of media modules such as 10/100BaseT, single mode 10BaseFL and 100BaseFL and multimode 10BaseFL and 100BaseFL. The Ethernet switch shall be an intelligent device capable of automatically re-routing communications in the event of a downstream failure or cable malfunction.

2. Shall be installed in a redundant ring topology capable of recognizing and responding to a loss of connection in the redundant ring in less than 300ms.
3. The unit shall be capable of full and half duplex communication and housing multiple Ethernet modules supporting any standard Ethernet media at 10/100megabits per second Ethernet speed. Ethernet modules will be available for direct connection to an Ethernet network using10BaseT, or 100BaseTX (RJ-45), and fiber optic 10Base FL or 100Base FX. All modules will be supplied with integral LED indicators for monitoring communication link status. All fiber optic modules will be IEEE 802.3 FIOL compliant.
4. Configured to accept power from two independent 24VDC power supplies. Upon loss of power from the primary power supply, the switch shall automatically switch from the primary to the secondary power supply without loss of operation.
5. The switch shall be able to signal device faults through an alarm dry contact output on the switch. The alarm contact shall be able to signal port link and power supply loss.
6. Ethernet Switch will be DIN rail mountable.
7. The Ethernet Switch shall support SNMP management.
8. Switch(s) shall be Hirschmann MICE industrial Ethernet switch, Phoenix MMS series or approved equal.

2.03 SYSTEM PERFORMANCE

A. The systems shall be configured to meet the following performance requirements:
   1. Outputs to field devices such as door locks shall activate within 300 msec of the touch screen icon activation. Activation of any touch screen icon or control switch shall provide a short audible tone.
   2. Video screen displays shall be refreshed within 300 msec. Screen graphics shall be stored in RAM to effect fast refresh with no moving parts. Storage on disk drive shall be for back-up purposes only
   3. The system shall annunciate alarms including touch screen display, video graphic alarm display, and audible tone in 500 msec or less from the time the field device is activated. Alarm audibles shall be distinctly discernible from intercom call-in tones and touch screen audible feedback tones.
   4. Touch screen terminals shall not be interdependent. The failure of one touch screen terminal shall not affect the operation of other touch screen terminals. The use of server based applications is strictly prohibited. Each Touch screen stations shall contain a licensed copy of the VGUI software.
   5. System faults or crashes shall not be capable of activating field outputs such as door locks during system failure or reboot.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.
B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.
C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280120 – June 17, 2024

SECTION 280140 - PROGRAMMABLE LOGIC CONTROLLER

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Programmable Logic Controllers as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional control system.

B. Related Sections:

1. Section 11190 Detention Equipment
2. Section 08710 Door Hardware
3. Section 260000 Electrical
4. Section 280000 Security Electronics, General
5. Section 280120 Touch Screen System
6. Section 280150 Electronic Relay System
7. Section 280200 Intercommunications System
8. Section 280300 IP Closed Circuit Television System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Provide materials, equipment, programming and services as required to install programmable logic controllers as shown on the drawings or as specified herein.

B. Major Sub-systems include:

1. Programmable Logic Controllers (PLC's).
2. Electronic relay system.

1.04 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this Section with that of other sections as required ensuring that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.05 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:
   1. Submit catalog cuts for all equipment and devices being furnished under this Section.

1.06 DESCRIPTION

A. Programmable Logic Controllers (PLC) shall provide control and monitoring functions for systems as described on the drawings and in these specifications.
B. The controllers shall provide all necessary logic functions, timing functions, memory, software, input/output points and communication capabilities for the operating features required to meet all of the requirements for the specifications.
C. Logic functions shall include but limited to AND, OR and INVERT functions with sufficient levels to provide operating features required to perform all of the functions required by the specifications.
D. Timing functions shall include, but not be limited to, on-delay, off-delay, stepping and pulsing. Sufficient variations of programmable timing shall be available to provide all the operating features as required by the specifications.
E. The controller shall be standard off the shelf, commercially available equipment. Proprietary or custom cage mounted discrete logic cards or PLC units and associated software such as those manufactured by MTI, Simplex, ICOTECH and Comtec are not acceptable.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The PLC shall be the product of a manufacturer engaged in the production of controllers for industrial application for a minimum of ten years. Only manufactures with national distribution and local parts outlets will be considered.
B. The program shall be developed for each controller on an individual basis and shall be stored in a non-volatile memory.
C. The programming format shall be traditional relay ladder logic utilizing basic and advanced instruction sets for function generation. Controllers that utilize spreadsheets and other means of programming shall not be acceptable.
D. The I/O modules shall be standard backplane type mounting and shall contain status LED’s for I/O point on the module. Input/Output modules shall be 32, 64 or 96 point modules and available in both sinking and sourcing inputs.
E. I/O modules shall be installed in any available slot in the CPU or expansion baseplates, and shall require no tools for insertion and extraction.
F. The system design shall accommodate the replacement of assemblies without having to disconnect field wiring. Wherever possible, removable connectors shall be used to connect field wiring to the individual circuit board assemblies
G. The controller shall operate on 105 to 130 VAC, 60 Hz and contain an Integral circuit breaker for overload protection. The controller shall Operate in temperatures of 0 to 60C and up to 95 percent humidity(non-condensing). The controller shall conform to electrical noise standards of IEEE-472.
H. PLC CPU and all associated power supplies (logic and CPU) shall be powered by a UPS.
I. The PLC shall be Modicon Quantrum Series, Allen-Bradley PLC5 Series, GE Fanuc Series 90-70, Omron CS1 Series, or pre-approved equal

PART 3 - EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280140 – June 17, 2024

SECTION 280150 - ELECTRONIC RELAY SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Electronic Relay System as specified herein. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional control system.

B. Related Sections:

1. Section Detention Equipment
2. Section 08710 Door Hardware
3. Section 260000 Electrical
4. Section 280000 Security Electronics, General
5. Section 280120 Touch Screen System
6. Section 280140 Programmable Logic Controller
7. Section 280200 Intercommunications System
8. Section 280300 Closed Circuit Television System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Provide relays, terminals, power supplies, cabinetry and other equipment as required to install an Electronic Relay System to facilitate a completely function system as shown on the drawings or as specified herein.

B. Major Sub-systems include:

1. Programmable Logic Controllers (PLC's).
2. Electronic relay system.

1.04 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.05 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.

1.06 DESCRIPTION

A. The relays shall provide the actual switching of power to all electric locking hardware, lights etc.
B. All relays shall be mounted in NEMA-1 type cabinets with removable steel mounting plate. The cabinet shall be sized according to the number of relays required by the job and constructed of code grade steel. The cabinets shall be mounted where shown on the drawings.
C. All relays shall be of the electro-mechanical type. The use of solid state type relays is strictly prohibited.
D. All relays, terminals and other equipment shall be standard off the shelf, commercially available components.
E. Relays and terminals for each device, i.e. doors, shall be grouped together and each terminal labeled with the device designation, wire color, power supply nomenclature and PLC I/O.
F. Each door shall have a device for overcurrent protection. Overcurrent protection devices shall be circuit breakers, fuses shall not be acceptable. The overcurrent device shall provide protection for both constant lock power (if applicable) and unlock/lock signal voltage.
G. All control wiring in the relay cabinet shall be grouped and laced with nylon tie straps with a maximum spacing of one inch. Straps will be placed within 1/2" on each side of all bundle breakouts. Wiring will be supported at intervals not exceeding four inches and labeled at both ends.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Relays
   1. Nominal input voltage 24 VDC.
   2. Nominal input current 9 mA.
   3. Typical response time 5 ms.
   4. Typical release time 8 ms.
   5. Continuous current rating 10 A.
   6. Relays shall be Din rail mounted with a base structure and field replaceable relay module. Relay boards containing multiple relays shall not be acceptable.
   7. Shall have LED indication for relay status.
   8. Acceptable Manufacturers
      a. Phoenix
      b. Omron
      c. Idec
B. Power Supplies
   1. Nominal input voltage 115 VAC.
   2. Nominal output voltage 24 VDC.
   3. Output current 10 A.
   4. MTBF > 500,000 hrs
   5. Ambient temperature operating range -25 C to 70 C.
   6. Din rail mounted
   7. Acceptable Manufacturers
      a. Phoenix
      b. Power One
C. Circuit Breakers
   1. Shall be thermal miniature circuit breaker, pluggable in a screw type terminal block.
   2. Sized for the device being protected.
   3. Rated surge 3 kV.

4. Nominal voltage 65 VDC, 250 VAC.
5. Ambient operating temperature -20 C to 60 C.
6. Acceptable Manufacturers
   a. Phoenix

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. All control wiring systems shall use solid or stranded copper conductors. Stranded conductors shall be acceptable only where all terminations can be made to lugs. Where stranded conductors are used, all terminations shall be made with crimp type lugs, correctly sized for termination, and applied to conductor with crimping tool intended for use with the lug used.
C. All wiring systems shall be labeled and color coded with labeling and coding shown on shop drawings. White conductors shall be used only for neutral conductors and green only for grounding conductors. All conductors within junction boxes, pull boxes and equipment enclosures shall be grouped and laced with nylon tie straps with identification tabs (equivalent to Ideal Industries #41-693 write-on I.D. marker plates) in individual sets, serving individual locks or groups. Conductor group shall be identified on the tab with respect to room or area served. Control system conductors shall not be spliced; control conductors shall be continuous between the control panel and the relay cabinet.
D. Install in accordance with all local and pertaining codes and regulations.
E. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
F. Equipment shall be ready to use condition at end of installation.
G. Energize equipment in accordance with manufacturer's instructions.
H. All panels must be certified and listed by UL and must be labeled accordingly.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280150 – June 17, 2024

SECTION 280200 - INTERCOMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Intercommunications equipment as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional Intercommunications system.

B. Related Sections:

1. Section 11190 Detention Equipment
2. Section 260000 Electrical
3. Section 280000 Security Electronics, General
4. Section 280120 Touch Screen System
5. Section 280140 Programmable Logic Controller
6. Section 280300 Closed Circuit Television System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Provide relays, terminals, power supplies, intercom amplifiers, paging amplifiers, cabinetry and other equipment as required to install an Intercom System to facilitate a completely function system as shown on the drawings or as specified herein.

B. Major Sub-systems include:

1. Programmable Logic Controllers (PLC's).
2. Touch Screen Control Stations.

1.04 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.
2. Submit a complete Intercom System riser diagram. Diagram shall include labeling of each station and the corresponding relay card point for termination, interconnecting wiring of all components including but not limited to relay cards, intercom amplifiers, paging amplifiers, intercom stations, paging speakers and master intercom stations.

1.05 DESCRIPTION

A. The relays shall provide the actual switching of audio paths to all intercom stations and paging zones.
B. All relays shall be mounted in NEMA-1 type cabinets with removable steel mounting plate. The cabinet shall be sized according to the number of relays required by the job and constructed of code grade steel. The cabinets shall be mounted where shown on the drawings.
C. All relays shall be of the electro-mechanical type. The use of solid state type relays is strictly prohibited.
D. All relays, terminals and other equipment shall be standard off the shelf, commercially available components.
E. All intercom station and paging zone termination points shall be permanently labeled in the cabinet.
F. The PLC shall be the basis of control for the integrated intercom system and shall provide switching and control through a series of input and output points from the PLC.
G. All intercom controls shall be via the Touch screen control stations and/or Graphic Control Panels.
H. Each remote station shall be a security grade station with a speaker, microphone, and a call push-button.
I. Paging speakers located within inmate accessible areas shall have a vandal proof baffle installed.
J. Each operator position shall have the option of communicating via desk-mounted intercom station employing a microphone and a speaker, or a headset. The desk mounted intercom station shall be equipped with a push-to-talk switch. A foot switch shall be furnished and installed to operate in parallel with the desk mounted switch.
K. The Programmable Logic Controllers shall provide outputs to automatically call up cameras associated with each intercom station on the control panel's monitor while an intercom link is connected. Camera call-ups for each station are to be determined and at the discretion of the Architect/Engineer.
L. For conditions where two CCTV cameras are identified to be viewed upon selection of the intercom, video shall be displayed on adjacent movement control monitors. When a single camera is associated with the intercom selection, CCTV video shall be displayed on one monitor and the adjacent monitor shall be blank.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following listed manufacturers, subject to compliance with the specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this specification. Proprietary or custom units and associated software such as those manufactured by MTI, Simplex and Comtec are not acceptable.
B. Audio control boards as required to interface to remote intercom stations and paging zones.
C. Power Supplies. Redundant power supplies shall be provided with alarm reporting of any failed power supply.
D. Discrete input/output boards.
E. Intercom master stations.
F. Interface boards to the PABX for paging access (where required).
G. All software and programming to perform the functions described herein.
H. Custom interface to the Touch screen control stations and/or Graphic Control panels.

I. All consoles shall have a gooseneck type, microphone with cardioid pattern, permanently mounted to the top of the console panel. Microphone shall be as manufactured by Astatic Model 827-17 or approved equal.
J. All consoles shall have volume control for the intercom monitor speaker.
K. System shall be the Tech-Works/Phoenix Intercom Systems or approved equal.

L. Intercom Amplifiers
1. Rated Power – 20 Watts @ 25 VRMS (balanced).
2. Microphone Input – 1000 ohms balanced, –80dBm, with phantom power.
3. Line level recording output.
4. Operator Speaker Output: 3 Watts into 25 Volt speaker.
5. Frequency Response 250 Hz to 10KHz.
6. Distortion at Full Rated Output < 1% T.H.D.
7. Page line level output.
8. Power: 24VDC, 2A Power Supply.
9. Unit shall be Tech Works ICA-220D or approved equal.

M. Paging Amplifiers

1. 60 Watt Amplifiers
a. Rated Output – 60 Watts RMS.
b. Frequency Response – 40 Hz to 15 KHz ±1.5 dB at -3 dB below RPO.
c. Distortion – Less than 3%, 60 Hz to 15 Khz. Less than 2% 70 Hz to 10 Khz.
d. Noise Level – 84 dB below RPO (input control full on). 90 dB below RPO (input control full off).
e. Input Sensativity – 0.3 volts for RPO.
f. Input Impedance – 13,000 ohms unbalanced.
g. Output Impedance – 10.4 ohms, 25 V line.
h. Center Tap Balance - ± 2%.
i. Output Regulation – Less than 2dB, full load to no load.
j. Auxiliary Power Available – 1.2 amp @ 28 VDC fully isolated.
k. Unit shall be Rauland-Borg model DAX 60 or approved equal.

2. 120 Watt Amplifiers
a. Rated Output – 120 Watts RMS.
b. Frequency Response – 40 Hz to 15 KHz ±1.5 dB at -3 dB below RPO.
c. Distortion – Less than 3%, 60 Hz to 15 Khz. Less than 2% 70 Hz to 10 Khz.
d. Noise Level – 84 dB below RPO (input control full on). 90 dB below RPO (input control full off).
e. Input Sensativity – 0.3 volts for RPO.
f. Input Impedance – 13,000 ohms unbalanced.
g. Output Impedance – 5.2 ohms, 25 V line.
h. Center Tap Balance - ± 2%.
i. Output Regulation – Less than 2dB, full load to no load.
j. Auxiliary Power Available – 1.2 amp @ 28 VDC fully isolated.
k. Unit shall be Rauland-Borg model DAX 120 or approved equal.

N. Intercom Station Card
1. Shall contain 25 DPDT relays.
2. Relays – 24 VDC at 25 mA; DPST precious metal contacts.

3. Each relay shall be hermetically sealed to prevent contact contamination, and have a life expectancy of more than 1,000,000 operations.
4. Unit shall be Phoenix Contact 2907028 or approved equal.

O. Power Supplies
1. Output Voltage – 24 VDC.
2. Output Current – 10 amps DC.
3. Efficiency > 92.5 %
4. Residual ripple < 50 mVPP (with nominal values)
5. Status display "DC OK" LED green / UOUT < 0.9 x UN: LED flashing
6. Ambient temperature (operation) -25 °C ... 70 °C (> 60°C derating)
7. Max. permissible relative humidity (operation) 95 % (at 25°C, no condensation)
8. Unit shall be Phoenix Contact QUINT-PS/1AC/24DC/10.

P. Intercom Stations
1. Intercom slave station shall be a flush-mounted security type with a 3” acrylic impregnated cotton cloth cone speaker. The unit shall have a momentary call-in switch, stainless steel tamperproof hardware, and a backbox. Unit shall have security steel offset grill and a ll-guage stainless steel plate. Unit shall mount on a standard three gang 3 ½” deep masonary box. Gangable type boxes shall not be acceptable. Mount unit 48” AFF to top. All units mounted in exterior spaces shall be of the weatherproof configuration.
2. Intercom stations shall be Quam CIS2/25 or approved equal.

Q. Paging Speakers
1. 8” dual cone.
2. Power Handling – 25 Watts peak, 15 Watts RMS.
3. Sensitivity – 97 dB peak, 94 dB average.
4. Frequency Response – 45 Hz to 19 Khz nominal,.
5. Dispersion - 105º (2 Khz octave band, -6 dB points).
6. Magnet Weight – Nominal, 10 oz.
7. Shall have a built in matching transformer for both 25V & 70V audio lines.
8. Shall be Quam 8C10PAOT or approved equal.

R. Exterior Paging Horn
1. Power rating – 15 Watts continuous.
2. Frequency Response – 40 to 14,000 Hz nominal.
3. Sensitivity – 120 dB at 15 Watts (peak).
4. Dispersion Angle - 70º (-6 dB, 2000 Hz octave band).
5. Shall be Quam QH16T or approved equal.

S. Vandal Proof Speaker Baffle
1. Shall be cast from aluminum alloy with a tensile strength of 44,000 PSI and reinforced with a perforated 22-guage CRS stud-mounting loudspeaker plate.
2. Shall be matched with the appropriate surface or recessed speaker enclosure.
3. Shall be Quam BS8VP or approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.
B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.
C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280200 – June 17, 2024

SECTION 280300 - IP VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide IP Video Equipment as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional IP Video System.

B. Related Sections:
   1. Section 11190 Detention Equipment
   2. Section 260000 Electrical
   3. Section 280000 Security Electronics, General
   4. Section 280120 Touch Screen System
   5. Section 280140 Programmable Logic Controller
   6. Section 280200 Intercommunications System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)
   1. UL 508 Industrial Control Equipment
   2. NEC National Electrical Code (latest edition)

D. Network – IEEE
   1. 802.3 Ethernet Standards
   2. 802.1x Port-based Network Access Control

E. Video
   1. ISO / IEC 14496–10, MPEG-4 Part 10 (ITU H.264)
   2. ISO / IEC 10918 – JPEG
   3. ONVIF – Profiles S G and T

F. Federal Communications Commission (FCC):
   1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.

1.03 WORK INCLUDED

A. Included under this Section of the work shall be the furnishing, installation, connection, aiming and testing of the complete IP Video System including, but not limited to, cameras, microphones, housings, mounts, cables, monitors, network switches, network video recorders and storage equipment, and fiber optic systems.

B. Major Sub-systems include:
   1. Programmable Logic Controllers (PLC's).
   2. Touch Screen Control Stations.

C. The lenses provided for cameras shall be changed as required, at no cost, to provide the Owner with an acceptable field of view.

1.04 APPROVALS

A. General
   1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:
   1. Submit catalog cuts for all equipment and devices being furnished under this Section.
   2. Submit a complete IP Video System riser diagram. Diagram shall include labeling of each camera and its corresponding head end equipment input, interconnecting wiring of all components including but not limited to digital controllers, digital video recorders, camera power supplies, monitors, control keyboards, and PLC interface connections.
   3. Submit plan drawings showing location, mounting and viewing angle of each camera.

1.05 DESCRIPTION

A. The IP Video System shall monitor spaces as shown on the drawings and function as shown on the IP Video System functional schematic.

B. All cameras shall be recorded, and video storage shall be sized to retain recordings for all video for a duration of 30 days. All cameras shall be recorded at their native resolution at a rate of 8 images per second. Recording shall be calculated for a minimum of 70% motion.

C. A VMS integration method shall be furnished and installed to provide auto select and manual selection of video cameras. Auto-select shall be initiated by acknowledging intercom call-in requests or by inputs from the Touch Screen or desk mounted video control panels. A manual video selector shall be incorporated into the Touch Screen System to provide for selection of a specific camera to be monitored by an operator. Switching logic for auto selection of video may be a single logic control unit or may represent logic control signals generated from other systems such as the intercom system or door locking control system.

D. Video Switching/Control:
   1. The Touch Screen station shall be equipped with two intercom video segments for movement control. The first segment (ex. M1) shall view the side of the door from which the intercom call was initiated. The second segment (ex. M2) shall view the opposite side of the door. Cameras on both sides of a door will be called up and displayed simultaneously upon acknowledging an intercom call. If a door has only one camera viewing it, the segment displaying the side without a camera shall be blank. Activating an intercom by touching the intercom icon on the touch screen shall switch the associated cameras to these intercom video segments. For conditions such as elevator lobbies, monitors shall display lobby video and cab video.
   2. Some Control Stations are equipped with two intercom call-up monitors for movement control. These are designated as shown on the drawings. The first monitor (ex. M1) shall view the side of the door from which the intercom call was initiated. The second monitor (ex. M2) shall view the opposite side of the door. Cameras on both sides of a door will be called up and display simultaneously upon acknowledging an intercom call. If a door has only one camera viewing it, the monitor displaying the side without a camera shall be blank. Activating an intercom by touching the intercom icon on the touch screen shall switch the associated cameras to these intercom call-up monitors. For conditions such as elevator lobbies, monitors shall display lobby video and cab video.

E. The PLC shall be the basis of control for the integrated IP Video System Camera call-up. A communications interface shall be provided between the PLC and the IP Video System.

F. Software Licensing and Warranty:
   1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.

2. The VMS Software should be completely free for live streaming or playback of offline media files (images, videos).
3. Desktop Client Software shall be available for download at no additional charge to the owner. There shall be no license fee associated with Desktop Client Software.
4. Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following listed manufacturers, subject to compliance with the specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this specification.

B. Acceptable Manufacturers:
   1. Avigilon Motorola
   2. Hanwha-Techwin, Teaneck, NJ
   3. Pelco, Fresno, CA
   4. Bosch, Lancaster, PA

C. Hanwha-Techwin is used as the basis of design. Comparable equipment from other listed acceptable manufacturers is approved. Provide make and model numbers that meet or exceed cameras listed herein.

D. Cameras:
   1. IP Cameras shall be the standard product of one manufacturer complying with not less than the specifications contained herein. Installation of each camera shall include mounting brackets and/or camera housings fully compatible with the camera provided. All interior and exterior cameras shall be equal to the models specified following.
   2. Type 1-Indoor Mini Dome, Surface Mounted 2 MP:
      a. Camera shall incorporate a modular design having the mounting plate, camera case, camera module and dome cover being separate components. The camera module shall magnetically attach to the camera case and be interchangeable between camera models.
      b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
      c. Tamper-Resistant Hardware
      d. Minimum Illumination: Color: 0.015Lux (F1.4, 1/30sec), BW: 0.0015Lux (F1.4, 1/30sec)
      e. Motorized Varifocal Lens of 2.8 mm to 12.0 mm with Auto Iris
      f. Angular Field of View
         1) H: 119.5°(Wide)~27.9°(Tele)
         2) V: 62.8°(Wide)~15.7°(Tele)
         3) D: 142.1°(Wide)~32.0°(Tele)
      g. Manual Pan / Tilt / Rotate Range: 0˚~360˚/ -45˚~85˚/ 0˚~355˚
      h. Resolution: 2.0 Megapixel (1945 X 1097)
      i. Digital Image Stabilization – built-in gyro sensor
      j. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
         1) Day & Night: Auto (ICR)
         2) Wide Dynamic Range: 150dB
      k. Privacy Masking: 32ea, polygonal zones
      l. Analytics: Defocus detection, Fog detection, Face detection, Motion detection, Digital auto tracking, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line/Directional detection, Audio detection, Sound classification, Shock detection.

m. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
n. H.265/H.264: Maximum 60fps, MJPEG: Maximum 30fps
o. Multiple streaming (Up to 10 profiles)
p. Shall support ONVIF Profile S/G/T
q. Edge Storage: Micro SD/SDHC/SDXC 1slot maximum 512GB
r. 12 VDC or POE
s. Operating Temperature Range -13° F to 140° F (-25° C to 60° C).
t. Camera shall be XND-6081V or approved equal

3. Type 2-Outdoor Mini Dome, Surface Mounted 2 MP:
   a. Camera shall incorporate a modular design having the mounting plate, camera case, camera module and dome cover being separate components. The camera module shall magnetically attach to the camera case and be interchangeable between camera models.
   b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
   c. Tamper-Resistant Hardware
   d. Minimum Illumination: Color: 0.015Lux (F1.4, 1/30sec), BW: 0Lux (IR LED on)
   e. Motorized Varifocal Lens of 2.8 mm to 12.0 mm with Auto Iris
   f. Angular Field of View
      1) H: 119.5°(Wide)~27.9°(Tele)
      2) V: 62.8°(Wide)~15.7°(Tele)
      3) D: 142.1°(Wide)~32.0°(Tele)
   g. Manual Pan / Tilt / Rotate Range: 0°~360° / -45°~85° / 0°~355°
   h. IR Viewable Length: 50m (164.04ft)
   i. Resolution: 2.0 Megapixel (1945 X 1097)
   j. Digital Image Stabilization – built-in gyro sensor
   k. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
      1) Day & Night: Auto (ICR)
      2) Wide Dynamic Range: 150dB
   l. Privacy Masking: 32ea, polygonal zones
   m. Analytics: Defocus detection, Fog detection, Face detection, Motion detection, Digital auto tracking, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line/Directional detection, Audio detection, Sound classification, Shock detection.
   n. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
   o. H.265/H.264: Maximum 60fps, MJPEG: Maximum 30fps
   p. Multiple streaming (Up to 10 profiles)
   q. Shall support ONVIF Profile S/G/T
   r. Edge Storage: Micro SD/SDHC/SDXC 1slot maximum 512GB
   s. 12 VDC or POE
   t. Operating Temperature Range -13° F to 140° F (-25° C to 60° C).
   u. Exterior wall mounted locations shall include all compatible wall mount accessories.
4. Camera shall be XNV-6081R or approved equal
5. Type 3-Outdoor Mini Dome, 5 MP:
   a. Camera shall incorporate a modular design having the mounting plate, camera case, camera module and dome cover being separate components. The camera module shall magnetically attach to the camera case and be interchangeable between camera models.
   b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
   c. Tamper-Resistant Hardware
   d. Minimum Illumination: Color: 0.07Lux (F1.2, 1/30sec), BW: 0Lux (IR LED on)
   e. Motorized Varifocal Lens of 3.9 mm to 9.4 mm with Auto Iris
   f. Angular Field of View

1) H: 92.1°(Wide)~38.7°(Tele)
2) V: 67.2°(Wide)~29.0°(Tele)
3) D: 119.9°(Wide)~48.6°(Tele)

g. Manual Pan / Tilt / Rotate Range: 0˚~360˚/ -45˚~85˚/ 0˚~355˚
h. IR Viewable Length: 50m (164.04ft)
i. Resolution: 2.0 Megapixel (1945 X 1097)
j. Digital Image Stabilization – built-in gyro sensor
k. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
   1) Day & Night: Auto (ICR)
   2) Wide Dynamic Range: 120dB
l. Privacy Masking: 32ea, polygonal zones
m. Analytics: Defocus detection, Fog detection, Face detection, Motion detection, Digital auto tracking, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line/Directional detection, Audio detection, Sound classification, Shock detection.
n. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
o. H.265/H.264: Maximum 30fps, MJPEG: Maximum 30fps
p. Multiple streaming (Up to 10 profiles)
q. Shall support ONVIF Profile S/G/T
r. Edge Storage: Micro SD/SDHC/SDXC 1slot maximum 512GB
s. 12 VDC or POE
t. Operating Temperature Range -13° F to 140° F (-25° C to 60° C).
u. Exterior wall mounted locations shall include all compatible wall mount accessories.
v. Camera shall be XNV-8081R or approved equal

6. Type 4- Corner Mounted 3 MP:
   a. Fully Integrated Enclosure with Camera and Lens
   b. Anti-ligature design & secure installation for corrections
   c. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
   d. Tamper-Resistant Hardware
   e. Minimum Illumination: Color: 0.3 lux (F2.0, 1/30sec) / B/W: 0 lux (F2.0, 1/30sec)
   f. Focal Length Lens of 2.8mm Fixed
   g. Angular Field of View
      1) H: 102˚
      2) V: 75˚
      3) D: 129˚
   h. IR Viewable Length: 10m (32.8ft) with 940nm IR LED
   i. Resolution: 3.0 Megapixel, 2048 x 1536
   j. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
      1) Auto (ICR)
      2) Wide Dynamic Range: 120dB
   k. Privacy Masking: 32ea, Polygonal
   l. Analytics: Tampering, Loitering, Directional/Virtual line detection, Defocus detection, Fog detection, Enter/Exit, Appear/Disappear, Audio detection, Face detection, Motion detection, Digital auto tracking, Sound classification, Shock detection
   m. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
   n. Audio out: Line out, Maximum output level: 1 Vrms
   o. H.265/H.264/MJPEG: Maximum 30fps at all resolutions
   p. Multiple streaming (Up to 10 profiles)
   q. Shall support ONVIF Profile S/G
   r. Edge Storage: microSD/SDHC/SDXC 1slot (up to 256 GB)

s. 12 VDC or POE
t. Operating Temperature Range +14°F to 131° F (-10°C to 55° C).
u. Camera shall be TNV-7010RC or approved equal

7. Type 5- 12 MP Fisheye:
   a. Fully Integrated Enclosure with Camera and Lens
   b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
   c. Tamper-Resistant Hardware
   d. Ultra-wide angle lens that produces videos in wide angels of view and provides on-board dewarping to convert hemispherical images into rectangular images
   e. Minimum Illumination: Color: 0.039Lux (F2.2, 1/30sec), B/W: 0Lux (IR LED on)
   f. Focal Length Lens of 1.08mm Fixed / F2.2
   g. Stereo graphic type lens, enhanced resolution for the peripheral regions
   h. Angular Field of View
      1) H: 187˚
      2) V: 187˚
      3) D: 187˚
   i. IR Viewable Length: 10m (32.8ft)
   j. Resolution: 12.0 Megapixel, 4000 x 3000
   k. Resolution Selections:
      1) Original view(1:1): 3008x3008~480x480
      2) Double panorama(2:1): 3584x1792~640x320
      3) Single panorama(4:1): 3584x896~640x160
      4) Quad view: 3584x2688~640x480
   l. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
      1) Wide Dynamic Range: 120dB
   m. Privacy Masking: 32ea, Polygonal
   n. Intelligence and Analytics – The camera shall have a suite of intelligent analytic functions.
      1) Motion detection with 8 definable detection areas with 8 point polygonal zones, and minimum/maximum object size.

      2) Detection of logical events of specified conditions from the camera's video
         a) Defocus detection
         b) Directional detection
         c) Motion detection
         d) Appear/Disappear
         e) Enter/Exit
         f) Loitering
         g) Tampering
         h) Virtual line
         i) Audio detection
         j) Sound classification
      3) Detection and classification of the following sound.
         a) Scream
         b) Gunshot

c) Explosion
d) Crashing glass

o. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
p. Built-in mic
q. Audio out: Line out, Maximum output level: 1 Vrms
r. H.265/H.264: Main/Baseline/High, MJPEG
s. Multiple streaming (Up to 10 profiles)
t. Shall support ONVIF Profile S/G/T
u. Edge Storage: SD/SDHC/SDXC (up to 1TB Max)
v. 12 VDC or POE
w. Operating Temperature Range -40°F to 140° F (-40°C to +60° C).
x. Exterior wall mounted locations shall include a compatible wall mount.
y. Camera shall be XNF-9010RVM or approved equal

8. Type 6- 2x 2MP Dual-Sensor Multi-directional:
   a. The Vandal Resistant Multi-Directional camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 512 GB) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and a hardened inner liner and be capable of operating in an indoor or an outdoor environment.
   b. The camera shall provide multi directional view and produce video in various view modes. The lenses shall be selectable depending on customer's requirement at site.
      1) Lenses shall be available in the following focal lengths:
         a) 2.4mm
         b) 2.8mm
         c) 3.6mm
         d) 6.0mm
   c. Video
      1) Video Compression: H.265, H.264, MJPEG, Multiple streaming
      2) Resolution: Dual 1080P (1920x1080) Sensors
      3) Frame Rate: H.265/H.264: Maximum 60fps
      4) Dynamic Range: Wide Dynamic Range, 150dB
      5) Digital Noise Reduction: SSNR
   d. Minimum Illumination:
      1) 2.4mm - Color: 0.055Lux (F2.0, 1/30sec)
      2) 2.8mm - Color: 0.055Lux (F2.0, 1/30sec)
      3) 3.6mm - Color: 0.055Lux (F2.0, 1/30sec)
      4) 6.0mm - Color: 0.055Lux (F2.0, 1/30sec)
   e. Imager: 1/2.8" 2MP CMOS
   f. Optical
      1) Viewing Angle:
         a) 2.4mm - H:135.4˚, V:71.2˚, D:161.6˚
         b) 2.8mm - H:107.4˚, V:62.2˚, D:122.0˚
         c) 3.6mm - H: 94.8˚, V: 49.3˚, D: 114.3˚
         d) 6.0mm - H: 50.4˚, V: 28.8˚, D: 58.1˚
   g. Application Programming Interface: ONVIF Profile S/G/T SUNAPI (HTTP API)
   h. Mechanical
      1) Dome: Polycarbonate, clear, UV-blocking anti-scratch, IK10 Impact Resistance
      2) Camera Body: Aluminum
      3) Pan / Tilt / Rotate Range: -176˚~+176˚/ 0˚~30˚/ -90˚~+90˚

i. Camera shall be PNM-7002VD with applicable lens modules or approved equal

9. Type 7- Indoor 4x 5MP Multi-Sensor Multi-directional:
   a. The Vandal Resistant Multi-Sensor/Multi-Directional camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (4 slots, 1 ea. per channel) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and a hardened inner liner and be capable of operating in an indoor or an outdoor environment.
   b. The camera shall provide 360-degree field of view and produce video in quad view mode. The fixed lenses/sensors shall be selectable depending on customer's requirement at site. Lenses provided shall provide a full 360º with the maximum vertical FoV.
   c. Lenses/Sensors shall be available in the following resolutions and focal lengths:
      1) 5 MP – 3.7mm
      2) 5 MP – 4.6mm
      3) 5 MP – 7mm
   d. Power:
      1) Input Voltage / Current: PoE+ (IEEE802.3at, Class4)
      2) Power Consumption: Maximum 25.5W
   e. Video
      1) Video Compression: H.265, H.264, MJPEG, Multiple streaming
      2) Frame Rate: H.265/H.264: 5 MP 30fps
      3) Dynamic Range: Wide Dynamic Range, 120dB
      4) Digital Noise Reduction: SSNR5 (2D + 3D noise filter) (On / Off)
   f. Minimum Illumination:
      1) Color: 0.16Lux (F1.6, 1/30sec, 30IRE)
      2) B/W: 0.16Lux (F1.6, 1/30sec, 30IRE)
   g. Imager:
      1) 1/1.8" 5MP CMOS
   h. Optical
      1) Viewing Angle:
         a) 5 MP – 3.7mm-H:97.5˚, V:71.9˚, D:126.2˚
         b) 5 MP – 4.6mm-H:77.9˚, V:57.9˚, D:98.7˚
         c) 5 MP – 7mm-H:50.7˚, V:37.8˚, D:63.8˚
   i. Application Programming Interface: ONVIF Profile S, SUNAPI (HTTP API)
   j. Pan / Tilt / Rotate Range:
      1) 5 MP – 3.7mm- -90˚~+90˚/ +36~+73˚/ -180˚~+180˚
      2) 5 MP – 4.6mm- -90˚~+90˚/ +21~+85˚/ -180˚~+180˚
      3) 5 MP – 7mm- -90˚~+90˚/ +12~+93˚/ -180˚~+180˚
   k. Camera shall be PNM-9002VQ or approved equal

10. Type 8-Exterior 8 MP Multi Sensor:
    a. Fully Integrated Enclosure with multiple Camera Sensors and Lenses
    b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
    c. Tamper-Resistant Hardware
    d. Field of View: 360-degree and producing video in quad view mode.
    e. Minimum Illumination: Color: 0.05 Lux (F1.6,30 IRE), B/W: 0Lux (IR LED on)
    f. Remotely adjustable Pan, Tilt, Zoom & Rotate Motorized Lenses of 3.2 ~ 10mm with Auto Iris
    g. Angular Field of View
       1) H: 109.0˚(Wide) ~ 33.2˚(Tele)
       2) V: 57.4˚(Wide) ~ 18.7˚(Tele)
       3) D: 132.0˚(Wide) ~ 38.0˚(Tele)

h. Resolution: 1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600,800x448, 720x576, 640x480, 640x360, 320x240
i. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
    1) Auto (ICR)
    2) Wide Dynamic Range: 120dB
j. Privacy Masking: 32ea, Polygonal
k. Intelligent Video Analytics: Defocus detection, Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Audio detection
l. H.265/H.264: Max. 60fps at all resolutions, Motion JPEG: Max. 30fps
m. Multiple streaming (Up to 10 profiles)
n. Shall support ONVIF Profile S/T
o. Edge Storage: Micro SD/SDHC/SDXC 4slots 256GB(each CH)
p. 12 VDC or POE
q. Operating Temperature Range -40°F to 131° F (-40°C to 55° C).
r. Exterior wall mounted locations shall include a compatible wall mount.
s. Camera shall be PNM-9084RQZ or approved equal

11. Type 9-Exterior 20 MP Multi Sensor:
    a. Fully Integrated Enclosure with multiple Camera Sensors and Lenses
    b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
    c. Tamper-Resistant Hardware
    d. Field of View: 360-degree and producing video in quad view mode.
    e. Minimum Illumination: Color: 0.07 Lux (F1.2, 1/30sec), B/W: 0.007 Lux (F1.2, 1/30sec)
    f. Remotely adjustable Pan, Tilt, Zoom & Rotate Motorized Lenses of 3.6 ~ 9.4mm with Auto Iris
    g. Angular Field of View
        1) H: 102.5˚(Wide) ~ 38.7˚(Tele)
        2) V: 74.2˚(Wide) ~ 29.0˚(Tele)
        3) D: 135.5˚(Wide) ~ 48.6˚(Tele)
    h. Resolution: 2560x1920, 2560x1440, 1920x1080, 1600x1200, 1280x1024, 1280x960, 1280x720,1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
    i. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
        1) Auto (ICR)
        2) Wide Dynamic Range: 120dB
    j. Privacy Masking: 32ea, Polygonal
    k. Intelligent Video Analytics: Defocus detection, Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Audio detection
    l. H.265/H.264: Max. 30fps/25fps (60Hz/50Hz) at all resolutions
    m. Multiple streaming (Up to 10 profiles)
    n. Shall support ONVIF Profile S/T
    o. Edge Storage: Micro SD/SDHC/SDXC 4slotsmaximum 256GB each, per channel
    p. 12 VDC or POE
    q. Operating Temperature Range -40°F to 131° F (-40°C to 55° C).
    r. Exterior wall mounted locations shall include a compatible wall mount.
    s. Camera shall be PNM-9085RQZ or approved equal
12. Type 10-Exterior 2 MP PTZ High- Performance Integrated Dome Systems:
    a. Auto Focus with Manual Override
    b. 40X Optical Zoom
    c. Pan / Tilt Speed: Max. 700˚/sec, Manual : 0.024˚/sec ~ 250˚/sec

d. Pan Range: 360˚Endless
e. Tilt Range: 110˚Endless (-20˚~ 90˚)
f. Presets: 300 ea.
g. Minimum Illumination: Color: 0.05Lux (F1.6, 1/30sec), B/W : 0.0Lux (IR LED On)
h. IR Viewable Length: 200m(656.17ft)
i. Angular Field of View
    1) H: 65.66˚(Wide) ~ 1.88˚(Tele)
    2) V: 39.40˚(Wide) ~ 1.09˚(Tele)
j. Resolution: 1920 x 1080, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600,800 x 448, 720 x 576, 720 x 480, 640 x 480, 640 x 360, 320 x 240
k. Wide Dynamic Range (WDR): 150dB
l. Digital Image Stabilization: Off / On (Built-in Gyro sensor)
m. Defog: Off / Auto / Manual
n. Privacy Masking: 32ea, Rectangular
o. Intelligent Video Analytics: Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Shock detection
p. Multiple streaming (Up to 10 profiles)
q. Shall support ONVIF Profile S/G
r. Edge Storage: MicroSD/SDHC/SDXC 2 slots (up to 1TB)
s. Operating Temperature Range -40°F to 131° F (-40°C to 55° C).
t. Pole mounted units and/or units mounted separate from the building shall be routed via fiber. Contractor to provide appropriate fiber transmission equipment for complete and successful operation.
u. Camera shall be XNP-6400R or approved equal

13. Ceiling Mounted Security Microphone
    a. Microphone type – Electret Condenser
    b. Output - Line Level (0dB @1KΩ), unbalanced
    c. Frequency response - 40 Hz to 15 kHz ± 1 dB
    d. Current drain - 4 mA
    e. Supply voltage - 12Vdc, 500mA
    f. Dimensions - 4"dia x 1 ½"H
    g. Sturdy ABS housing
    h. Microphone shall be Louroe Verifact “A”

E. All camera installations shall be securely attached to mounting surface. Use lead shields on solid masonry, toggle bolts for hollow masonry, and machine bolts for steel. All anchoring devices shall be rated to support not less than five times the total equipment weight.
F. Video Surveillance Monitors:
    1. Video Surveillance Monitors shall be the standard products of one manufacturer and compatible with the total system specified, herein, and complying with these specifications. Monitors and cameras shall be provided by the same manufacturer.
    2. Surveillance Monitors shall be LED flat panel type as indicated on the drawings and as specified herein. All monitors shall be U.L. listed.
    3. Twenty-Four (24) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
        a. LED Panel Resolution: 1920 x 1200
        b. Panel Aspect Ratio 16:10
        c. Pixel Pitch 0.270 x 0.270mm
        d. Contrast Ratio 1000:1
        e. Viewing Angle (H/V) 178°/178°
        f. Response Time 4 ms

4. Thirty-Two (32) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 2560 x 1440
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 3000:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 5 ms
5. Fourty-Three (43) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 3840 x 2160
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 4,700:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 8 ms
6. Fifty (50) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 3840 x 2160
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 4,700:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 8 ms

G. Client Workstations:
1. Remote monitoring environment for video and audio over the network.
2. Unit shall be able to display any camera on any monitor over the network.
3. Incorporates graphic map features to depict camera locations.
4. General Properties:
   a. Camera search and Discovery:
      1) Capable of searching Network Video Recorders for connected cameras.
      2) Cameras are Searched or Discovered:
         a) Camera will be automatically viewed and current camera information (fps, days of recording) displayed.
   b. Support up to four monitor outputs.
   c. Recording and Playback Functions:
      1) Simultaneous playback capability up to 128 video channels of resolutions of (4 cif to 12 MPS).
      2) Compression Support: CoH.265, H.264, and MJPEG.
      3) View AAC, PCM, g726, and MPS audio.
      4) Set recording schedules.
      5) Set up triggered recording based on:
         a) Sensor (input) detection.
         b) Camera event, analytics based in Wisenet Cameras.
         c) Motion detection.
         d) Video loss detection.
      6) Available recording settings that can be set up or changed by channel for standard and event-based recording types:
         a) Compression type.
         b) Resolution.
         c) Images per second.

d) Quality.
e) Data transfer limit.
f) Pre-event and post-event record duration.
g) I-frame and full frame recording.
7) Search recorded data by time, event trigger, motion alarms, events
d. Storage: 1x 256GBSSD.
1) USB connection for export device for video clip backup and settings export.
e. Live View:
1) Remote monitoring.
2) Streams: H.265, H.264, MJPEG.
3) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
4) Configure and exercise functions for connected PTZ cameras, including functionality with compatible USB joystick.
5) Capture and save snapshot images.
f. Up to Four High Definition local monitor outputs live viewing, playback, and backup functions.
g. ONVIF Profile S compliance.
5. System:
a. Processor: Intel® Core™ i3-9100 3.6Ghz to 4.2Ghz (4Cores, 4Threads, 6MB).
b. Memory: 8 GB DDR4.
c. Operating Systems: Windows 10 Professional.
d. USB Ports: Rear: (2) USB 3.1 Gen 1, (2) USB 2.0; Front: (2) USB 3.1 Gen 1, (2) USB 2.0.
e. Video Output: 3x Mini DisplayPort with 2x HDMI adapters.
f. Wi-Fi: IEEE 802.11ac.
g. Other Ports: 1x PS2, 2x Wi-Fi Antennas, 3.5 mm audio in/out, 1x SPDIF out.
h. Keyboard and Mouse: Included.
6. Video Compression: H.265, H.264, and MJPEG.
7. Events and Response Actions:
a. Triggers:
1) Motion.
2) Video loss.
3) Event defined by camera.
b. Response Actions:
1) Record.
2) E-mail.
3) Activate PTZ preset.
4) Event trigger program.
5) Sound output.
8. Playback:
a. Number of simultaneous channels: Not limited.
9. Network:
a. Connectivity: 1000 Base-T Ethernet, 2 x RJ-45 connectors.
b. Protocols Supported:
1) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP).
2) Configuration: Dynamic Host Configuration Protocol (DHCP).
3) Web Services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS).
4) Network Services: Address Resolution Protocol (ARP), Domain Name System (DNS), Internet Control Message Protocol (ICMP), Network Time Protocol

(NTP), Simple Network Management Protocol (SNMP v1/2c/3 - MIB-2), Universal Plug and Play (UPnP).
5) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP).
6) Multicast: Internet Group Management Protocol (IGMP).
7) Notifications: Simple Mail Transfer Protocol (SMTP).
8) Remote Access: Point-to-Point Protocol over Ethernet (PPPoE).

c. Security Features:
1) User password protection with group restrictions.
2) User access log.

10. Audio:
a. Direction: Bi-directional.
b. Compression: AAC (16/48 KHz), G.711 u-law, G.726 selectable.
c. Output: Line level (RCA).

11. Electrical:
a. Power: 100 to 240 VAC.
b. Power Supply: 250 W.

12. Environmental:
a. Mouse and Keyboard: Included.
b. Temperature; Operating and Storage: 32 to 122 degrees F (0 to 50 degrees C).
c. Humidity: 5 to 85 percent, RH non-condensing.

H. Rackmount Servers:
1. Network Video Recorder ("NVR"):
a. Record Video and Audio: 470 Mbps
b. Send data from video cameras to a hard disk array of 1 to 12 HDDs within a rack mountable format and enable playback of video and audio from the hard disk array.
1) Pre-configured with the VMS.
2) Remote monitoring environment for video and audio over network using a remote computer.

c. General Properties:
1) Camera Search and Discovery: Search network for connected compatible cameras via Onvif Profile S or the manufacturer’s native driver.
a) Cameras are Searched or Discovered:
(1) Cameras automatically registered and current camera information (fps, days of recording) displayed.
(2) Ability to selectively register as many as cameras can be found.
2) Support dual monitor out.
3) Support server backup if multiple servers are in the hive for failover for redundancy.
4) Recording and Playback Functions:
a) Support recording 128 dual streams (256 streams) from 352 x 288 (CIF) up to 4000 X 3000 (12 MP) per channel.
b) 470 Mbps network camera recording throughput.
c) Simultaneous Playback Capability: 128 video channels.
d) Compression Support: H.265, H.264, and MJPEG.
e) NVR to record and stream AAC, PCM, g726, and MPS audio.
f) View status of internal connected storage hardware.
g) Set recording schedules.
h) Set up triggered recording based on:
(1) Sensor (input) detection.
(2) Camera event, analytics based in the manufacturer’s cameras.

(3) Motion Detection.
(4) Video loss detection.

i) Available recording settings by channel for standard and event-based recording types:
(1) Compression type.
(2) Resolution.
(3) Images per second.
(4) Quality.
(5) Data transfer limit.
(6) Pre-event and post-event record duration.
(7) I-frame and full frame recording.

j) Available actions upon reaching full HDD storage capacity:
(1) Stop recording.
(2) Overwrite.

k) Search recorded data by time, event trigger, motion alarms, events.

5) Storage:
a) JBOD configuration for a maximum of 96 TB.
b) RAID Support: RAID 0/1/5/6/10/50/60 plus BBU (backup battery unit).
c) USB connection for memory/storage device for video clip backup and settings export.

6) Live View:
a) Remote monitoring using the manufacturer's supplied viewer.
b) Streams: H.265, H.264, MJPEG.
c) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
d) Configure and exercise functions for connected PTZ cameras, including functionality with compatible USB joystick.
e) Capture and save snapshot images.
f) Record current video in AVI format.

7) Remote Access:
a) Multicast or Unicast: Simultaneous access is unlimited.
b) Mobile Device:
(1) Supported Platforms:
(a) Android.
(b) IOS.
(2) Supported Remote Users: Unlimited amount either live or playback.
(3) Dynamic DNS (DDNS) support.

8) VGA and High Definition (HDMI) local monitor outputs live viewing, playback, and backup functions.
9) ONVIF Profile S compliance.
10) Alarm Connections: None on server. Use of I/O software module to support I/O control.

d. System:
1) Processor: Intel Core i5-7500 3.4 GHz.
2) Memory: 8 GB DDR4
3) Operating Systems: Windows 10 IoT Enterprise.
4) USB Ports: 6x USB 3.0 (rear), 2x USB 3.0 (front).
5) Video Output: 1x Display Port (rear), 1x HDMI (rear), 1x DVI (rear).
6) Other ports: 3.5 mm audio in/out, 1x SPDIF out.
7) Keyboard and Mouse: Included.
8) Sliding Rail Kit: Included.

e. Video Compression: H.265, H.264, MJPEG.
f. Recording:
    1) Channel Capability: No limit but recommended to use the manufacturer's storage Calculator.
    2) Bit Rate: 470 Mbps.
    3) Resolution Range: 352 x 288 to 4000 X 3000.
g. Events and Response Actions:
    1) Triggers:
        a) Motion.
        b) Video loss.
        c) Event defined by camera.
    2) Response Actions:
        a) Record.
        b) E-mail.
        c) Activate PTZ preset.
        d) Event Trigger program.
        e) Sound output.
h. Playback:
    1) Number of simultaneous channels: Not limited.
    2) Bandwidth: 470 Mbps.
i. OS Drive: OS Drive Bays: 1 to 256 GB SSD internally mounted.
j. Storage:
    1) Internal:
        a) Number of HDDs Bays: 1 to 12 Bays.
        b) Capacity per HDD: 1 to 8 TB.
        c) RAID 0/1/5/6/10/50/60 plus BBU (backup battery unit).
    2) External Types: USB HDD/Flash drive for backup of video clips, firmware update, settings backup/restore, log export.
k. Network:
    1) Connectivity: 1000 Base-T Ethernet, 2 x RJ-45 connectors.
    2) Protocols Supported:
        a) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP).
        b) Configuration: Dynamic Host Configuration Protocol (DHCP).
        c) Web Services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS).
        d) Network Services: Address Resolution Protocol (ARP), Domain Name System (DNS), Internet Control Message Protocol (ICMP): Network Time Protocol (NTP), Simple Network Management Protocol (SNMP v1/2c/3 - MIB-2), Universal Plug and Play (UPnP).
        e) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP).
        f) Multicast: Internet Group Management Protocol (IGMP).
        g) Notifications: Simple Mail Transfer Protocol (SMTP).
        h) Remote Access: Point-to-Point Protocol over Ethernet (PPPoE).
    3) DDNS: Support DDNS services offered by the Manufacturer and other publicly available service offerings.
    4) Security Features:
        a) User password protection with group restrictions.
        b) IP address filtering, list of allowed or blocked IP addresses.
        c) HTTPS(SSL) login authentication.
        d) User access log.

e) 802.1x authentication.
f) Restriction of network access/web viewer access.
5) Discovery: Manufacturer shall offer a discovery program to identify all devices of his manufacture on the network, as well as ONVIF Profile S conformant devices.

l. Alarm/Sensor Interface:
1) Input (0): NO or NC, selectable.
2) Output (0): NO or NC, selectable.
3) Use of I/O software module to support I/O control.

m. Audio:
1) Direction: Bi-directional.
2) Compression: AAC (16/48 KHz), G.711 u-law, G.726 selectable.
3) Output: Line level (RCA).
4) Output: Line level (RCA).

n. Electrical:
1) Power:100 to 240 VAC.
2) Power Supply: 800 W Redundant.

o. Mechanical and Environmental:
1) Color: Black / metal.
2) Front Bezel and lock.
3) Form Factor 2U Rack Mount Chassis. Sliding rails included.
4) Mouse and Keyboard: Included.
5) Dimensions (W x H x D): 17.2 x 3.5 x 26 inch (438 x 87.0 x 660 mm).
6) Weight: 30.86 lbs. (14 kg).
7) Temperature; Operating and Storage: 32 to 122 degrees F (0 to 50 degrees C).
8) Humidity: 5 to 85 percent, RH non-condensing.

2.02 VIDEO MANAGEMENT SYSTEMS (VMS)

A. Video Management Systems: For remote devices and sensors.
1. Software: Wisenet Wave v4.2 as manufactured by Hanwha Techwin America.
2. System Requirements:
a. Open video platform designed for use in any video application.
b. Specified Software: To include, free of charge, any API or SDKs necessary to integrate third party devices and systems.
c. Shall include a UART Bridge that will allow serial protocol communications to interface to HMI Software platforms. Interface shall allow the automatic call-up of cameras to tiles within designated monitors for functions such as Intercom Station video follow audio, alarm conditions and spot monitor camera call-up from Touch Screen Icons.
d. Specified Video Management Solution's Architecture: To include Desktop, Media Server, as well as the capability of Mobile, and Cloud applications.
3. Software Components Characteristics: Four applications working seamlessly together.
a. Cloud Application (if required): Enables simple remote connectivity, viewing, and management of an unlimited number of systems and users.
b. Media Server Application: Responsible for discovering, connecting to, and managing system users, devices, and associated data.
c. Desktop Application: Capable of acting as a stand-alone media player or as a client application for connecting to and managing systems.
d. Mobile Application (if required): For iOS and Android devices that allows users to connect to, view, search, and control IP cameras over Wifi or Data networks.
4. Built-In Developer and Integration Tools: Accessible from System Server's Web Admin Interface (compatible with all major browsers).
a. Generic Events Generator: Tool which builds HTTP Generic Event calls; a method of sending events from third party systems to the VMS, which can be used to trigger system

actions in the VMS.
b. Server API: SUNAPI implementation giving developers the ability to access every system feature available.
c. API Change Log: List of breaking changes in API from version to version.
d. Video Source Integration SDK: Integrate virtually any live or recorded video source (IP Cameras, NVRs, DVRs, etc.) into the VMS with methods for discovering, displaying, analyzing and recording video, as well as integrating device I/O ports and related motion detection information.
e. Storage SDK: Integrate potential storage into System. Allow developers to read from or write to any storage location; local, remote, or cloud-based (if required). Require implementing standard functions such as: I/O stream, if file exists, delete file, list of files in the folder, etc. Capable of using an FTP server as a storage location.

5. System Architecture:
a. Server Hive Architecture:
1) System servers are equal synchronizing system databases in real-time.
2) Users can connect to any system server to see and manage entire system.
3) Servers support automatic camera failover ensuring limited loss of video recording in event of hardware or network failure.
4) Servers use SQLite included in installation package.
b. One-click System Wide Updates:
1) System Administrators Capabilities:
a) Upgrade entire system via single button in Desktop Application.
b) Upgrade on demand to latest release or specific builds with specific functionality or bug fixes.
c) Apply an OTA (over-the-air) update.
d) Generate a URL to download a portable system-specific update package in ' Zip' file format which can be used to update servers without an active Internet connection.
c. Use secure technologies for inter-application communication and security.
1) OpenSSL for Network Connections: Deprecated and insecure protocols and use only TLS v1plus.
2) Email Server: Client (Mobile, Desktop, Web) Communications - HTTPS Email - TLS / SSL - TLS; default option.
3) Salted/Hashed Passwords: Local credentials protected using a salted MD5 hash, cloud credentials should use a complex multi-level hash.
d. The VMS will not require any licenses to increase the number of supported devices, users, or servers.

B. VMS Server Application:
1. Runs on the Following Operating Systems:
a. Microsoft:
1) Windows 10 IoT Enterprise.
2) Windows Server 2019 or later.
3) Windows 10 Enterprise Solutions.
b. Ubuntu Linux:
1) Ubuntu 14.04 LTS: Trusty Tahr.
2) Ubuntu 16.04 LTS: Xenial Xerus.
2. Minimum Compatible Computing Hardware:
a. Any hardware able to run a compatible operating system.
b. Capable of recording 128 dual-streaming IP cameras (256 streams) on a single core of an Intel Core i3 processor.
3. Initial Installation and Setup:

a. Publicly available, free download.
b. No prerequisite proprietary or 3rd party software and database technologies required during installation.
c. Installation Process: No user input once initiated.
d. After Installation is Complete: Setup process will allow system administrators to create a new system or to merge newly installed servers with existing systems.

4. Performance:
   a. Automatically discover, stream, and record any ONVIF Profile S IP camera located on same subnet as server application.
   b. Manually discover, stream, and record RTSP, HTTP, or UDP (multicast, unicast) streams.
   c. Concurrent TCP Connections: 1000.
   d. Record and Stream Video: Any resolution and frame rate, limited only by hardware.
   e. Automatic camera failover without any additional licenses.
   f. Unlimited number of users and custom user roles.
   g. Any type of storage medium - HDDs, SSDs, SD cards, DAS, NAS, or other network-attached storage devices or locations.
   h. User Login Credential Management: LDAP / Active Directory / Open LDAP integration.
   i. Record and Stream
      1) Video: H.264, H.265, and MJPEG.
      2) Audio: AAC, PCM (Mu-Law, A-law), g726, and MP3.
   j. Transcode Streams on Demand: For delivery to 3rd party system devices.
      1) Codecs: H.265, H.264, MJPEG or WebM.
   k. Pass-through high-res or low-res HLS streams from connected devices.
   l. Store archive indices in same location as recorded video files.
   m. Re-Index Archive Feature: Allow system administrators to recover archives from any storage medium.
   n. Boolean Events Engine: Allow operators to program and trigger system actions based on system, connected device, or HTTP events sent from 3rd party system or device.
   o. Send HTTP PUT or GET requests to 3rd party systems or devices.
   p. Support Addressing: IPv4 or IPv6.
   q. Operators to set custom network routing configurations for system servers to optimize network routing and usage.
   r. Allow operators to monitor CPU, RAM, NIC, and HDD usage in real time.
   s. Track all operator actions to allow audits.
   t. Generate automatic crash files for every crash of the Server application.
   u. Operator ability to change size of reserved disk space for storage drives.
   v. Automatically disable any system drive (drive containing the operating system) in computing hardware with more than one drive to ensure operating system drive does not become full.
   w. Configuration and events from binary I/O contacts on supported devices including IP cameras and I/O devices.
   x. Send email notifications via SMTP using TLS, SSL or unsecured connections.
   y. Scheduled backup of recording archives to local, networked, or cloud storage locations.
   z. On-demand backup of recording archives to local, networked, or cloud storage locations.
   aa. Concurrent-recording of all connected cameras / streams to two servers in real-time.
   bb. Server-side, CPU-based motion analysis for all connected IP cameras with no perceptible increase, less than 3 percent, in CPU usage.
   cc. Require no dedicated GPU in order to perform at maximum capacity.
   dd. Web Administration Interface Allowances:
      1) System administrators to view real-time server health monitoring statistics; CPU,

NIC, and HDD usage.
a) Hidden advanced page giving system administrators ability to modify advanced system settings.
2) Users to view live or recorded video from a single camera at a time in high or low resolutions.
3) Users to view all available servers in system.
a) Operators to disconnect the VMS Server from the VMS cloud application (if required).
b) Operators to switch between server interfaces.
4) Must support any RAID configuration of storage medium.

C. VMS Desktop Application:
1. Runs on the Following Operating Systems:
a. Microsoft:
1) Windows 10.
2) Windows Server 2019.
3) Windows 10 Enterprise Solutions.
b. Ubuntu Linux:
1) Ubuntu 14.04 LTS: Trusty Tahr.
2) Ubuntu 16.04 LTS: Xenial Xerus.
a) Apple / Mac.
3) OSX 10.11: El Capitan.
4) OSX 10.12: Sierra.
5) OSX 10.13: High Sierra.
2. Minimum Compatible Computing Hardware:
1) Any hardware able to run a compatible operating system with a CPU that supports OpenGL 2.1 and Intel HD Graphics 3000 (or higher).
b. Will not require any dedicated graphics drive to work at full capacity; 64 streams on a 64 bit OS, 24 streams on a 32 bit OS, and use the CPU for all video decoding and rendering.
3. Installation and Configuration of VMS Client Application:
a. Publicly available, free download.
b. No prerequisite proprietary or 3rd party software and database technologies required during installation.
c. Installation Process: No user input once initiated.
4. Performance and Basis Structure:
a. Navigation Panel: Main menu button, an interactive cloud-login icon, tabbed layouts, minimize and maximize icons, a contextual help icon, and a close application icon.
b. Resource Panel (Left): Contains all system resources (Servers, Devices, Users, Layouts, Offline files, etc.) with collapsible structure and a keyword search mechanism to allow operators to quickly search for a display live streams / cameras, offline video and image files, or any combination thereof.
c. Notifications Panel (Right): Shows all system or rules-engine generated notifications which can be clicked on to display relevant resource in the viewing grid.
d. Timeline Panel (Bottom): Allows for navigation and search of recorded video files.
e. Viewing Grid (Main Viewing Area): A flexible adaptive grid interface which allows operators to create and share customized layouts of system resources.
5. Operation: Allow operators to do the following.
a. View and interact with the following types of media:
1) Live Streams: H.265, H.264, MJPEG.
2) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
3) I/O Devices: Status and triggers.

4) Servers: Real-time server health monitoring status.

b. Scroll to and zoom in on any zone of viewing grid.
c. Drag and drop to reassign cameras from one server to another server.
d. Via a flexible timeline, view dates of any and all archived video in the System for a specific camera, or groups of cameras.
e. Manually Create Bookmarks: With start time, end time, name, description, and tags, for later search. Bookmarks must also be able to be created using the Rules engine.
f. Create Soft Triggers: Programmable, customizable buttons which sit on top of streams in Viewing Grid, to trigger any available system action.
g. Icons Located on the Top of Live Camera Streams: Dewarp fisheye cameras, control PTZ cameras, apply client-side image enhancement, execute smart motion search, create zoom windows, rotate items to any orientation, and activate stream or file info.
h. Create Zoom Windows: 63 zoom windows on a single item in a 64 bit OS, 23 zoom windows in a 32 bit OS; a magnified view of a part of a live stream, recorded videos, or static images.
i. Execute a Smart Motion Search: By selecting a subset of a live camera stream with results shown in red on the flexible timeline. Smart Motion search should be able to search a year (12 months, 365 days) of archived video in less than one second.
j. Search live cameras by name, manufacturer, IP address, MAC address, and status (e.g. live).
k. Search video archives by date and time with a responsive, adaptive timeline.
l. Operators to customize the background image of the application with supported image types.
m. Support digital mapping by allowing operators to add and customize background images including opacity and number of grid points.
n. Utilize adaptive scaling technology to automatically switch between high and low resolution streams during live and recording playback to optimize CPU and network usage.
o. Log in to the Cloud application (if utilized) in order to quickly connect to any shared system.
p. Quickly switch between previously connected or cloud-accessible systems (if utilized) using searchable tiles that show system name and status.
q. Using a Storage Analytics feature analyze storage capacity of the system based on available drives and real-time and historical bandwidth analysis.
r. Management and configuration of all system devices, users, and resources in a single unified interface.
s. Fast-forward and fast-reverse of archived video up to 16x normal speed.
t. Show operators which system server they are connected to.
u. Connect to previous versions by automatically downloading and switching to compatible versions.
v. Automatically discover available systems on the same network as the computer running the Desktop application.
w. Automatically recover and reconnect to a system in the instance the server the operator is connected to becomes inaccessible for any reason.
x. Show or hide adaptive thumbnails in the timeline panel.
y. Synchronize all items on a layout or disable synchronization to view live and recorded video at the same time.
z. Adaptive settings dialogs, to switch dialog content while the dialog is open by clicking on a resource.
aa. Batch configuration of camera recording schedules, fps, and quality.
bb. Drag and drop multiple system resources onto the Viewing Grid at the same time.

cc. Modify time synchronization settings for the system to utilize online resources (NTP servers) or to set a dedicated local time server.
dd. View a full list of system cameras and devices in a single dialog.
ee. View, Search and Export:
    1) All system events.
    2) All system bookmarks.
    3) System logs.
    4) Audit trail of operator actions and replay related video.
ff. Backup and restore system database.
gg. Create an unlimited number of custom user roles.
hh. Create and share lockable layouts.
ii. Update layouts in real time.
jj. Record their screen in full resolution and up to 30 fps.
kk. Add a local folder to add local files for search and playback.
ll. A Video Wall mode to control the application remotely.
mm. A Media Player mode to use the application as a media player.
nn. Remember past system connections and user credentials and will allow operators to quickly search for and switch between systems.
oo. Adjust aspect ratio and streaming quality (high resolution or low resolution) of items displayed on the viewing grid.
pp. Display I/O devices as an individual item on the viewing grid create custom names for inputs and output.
qq. Customize the layout of I/O panels on the item in the viewing grid including indicators for inputs and buttons for outputs.
rr. De-warp any fisheye lens using automatic calibration or manual calibration without the need for any third party SDKs.
ss. Create fully customizable viewing tours which include any combination of live video streams, offline videos, images, websites (or URLs), I/O devices, and Server health monitoring status.
tt. Modify and save a shared layout to affect an instantaneous change to that layout on the VMS Desktop application of any user connected to the system viewing that layout (when the system administrator saves the layout the layout will update in real time for any user viewing that layout).
uu. Support two-way audio between operators and supported devices.
vv. Support audio alerts as an action that can be played on users' computers or connected system devices.
ww. Support PTZ presets and tours.
xx. Support PTZ presets and tours in fisheye cameras using de-warp mode.
yy. Schedule recording for connected cameras and devices with options to force minimum and maximum storage durations.
zz. Configure pre and post recording for motion events.
aaa. Optimize camera streaming quality from connected devices automatically using low, medium, high, best quality selectors or manually in the camera.
bbb. Export video by selecting an area on the timeline and right clicking to export.
ccc. Support single video export in .avi, .mp4, or .mkv formats and will offer the option to transcode any client-side effects (image enhancement, de-warping, time stamps) as part of the exported video.
ddd. Support multi-video export in an executable format to create a fully portable version of the VMS Desktop application including all exported video files.
eee. A rapid review export feature which will allow operators to compress any length of video into a short video (e.g. export 8 hours of archives into a 30 second video clip).

fff. Activate or deactivate system licenses on Internet connected systems.
ggg. Force open an alarm layout triggered by any system or 3rd party event with one or many associated cameras or resources.
hhh. A hidden configurable method of increasing the amount of items allowed on the viewing grid.
iii. Adjust configuration of devices.
jjj. Force users to set the camera's initial password upon enrollment for best cyber security practices.

D. VMS Mobile Application (if required):
1. Runs on the Following Operating Systems:
a. Google Android.
b. Android 4.0: Ice Cream Sandwich.
c. Android 4.1, 4.2, 4.3: Jelly Bean.
d. Android 4.4: KitKat.
e. Android 5.0: Lollipop.
f. Android 6.0: Marshmallow.
g. Android 7.0 7.1: Nougat.
h. Android 8.0 8.1: Oreo.
i. Apple iOS: 5, 6, 7, 8, 9, 10, and 11.
2. Installation: Application to be available as a free download from Google Play or Apple iTunes stores. *No additional licensing fees shall be required for the utilization of the VMS Mobile Application.*
3. Performance:
a. Automatically discover available Systems on a local area network (LAN).
b. Store past system connections and credentials and allow users to quickly search for switch between systems.
c. Adaptive streaming and automatically adjust stream being displayed based on network speed.
4. User Capabilities:
a. Adjust streaming resolutions manually.
b. Search for cameras by name.
c. Fisheye de-warping of any fisheye lens without 3rd party SDK.
d. View live video from one system.
e. Log in to VMS Cloud layer to view and access systems shared with a user.
f. Control the display of any connected "Lite Clients" in the system.
g. Utilize a custom media player to render and display live thumbnails and video.
h. Search video using a calendar.
i. Search video using a flex timeline.

E. VMS Cloud Application (if utilized for off-site capabilities):
1. Supported Browsers: Allow users to log in from any modern web browser. (Google Chrome, Mozilla Firefox, Microsoft Edge, Opera, etc) from any type of device (mobile, PC, etc.)
2. Performance:
a. An optional add-on to VMS requiring no additional licensing.
b. Will first attempt a direct connection to system servers using NAT Traversal technology and be able to proxy traffic to ensure access to a system in case of ISP or routing issues.
c. Unlimited number of connected users and systems with no additional licensing.
d. Utilize secure networking technologies (OpenSSL, HTTPS) and a complex Salted MD5 hash for any stored.
e. Users to connect an unlimited number of systems to a single user account.
3. User Capabilities:
a. System Administrators:

1) Share access to a system using only an email address.
2) Assign custom user roles when sharing system access.

b. Users: Quickly search for and connect to cloud-connected systems by name.
c. Operators: View live or recorded video from one camera at a time on any cloud-connected system.
d. Passwords.

F. Digital Video Network Equipment
1. The digital CCTV network shall be a stand alone 1000 MB network furnished and installed by the Division 28 contractor. The owner's network may be, at the option of the owner, linked to the digital video network for accommodation of remote viewing PC's, but shall not be used as the primary means of transporting digital video.
2. Switches shall be 12, 24 or 48 port as applicable and defined below.
3. Each switch can operate as both a master controller and a forwarding processor.
4. Dynamic Host Configuration Protocol (DHCP) auto configuration of multiple switches through a boot server.
5. Dynamic Trunking Protocol (DTP) to facilitate dynamic trunk configuration across all switch ports.
6. Protocol Independent Multicast (PIM) for IP multicast routing is supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), and PIM sparse-dense mode. The IP Services image is required.
7. Inter-VLAN IP routing for full Layer 3 routing between 2 or more VLANs.
8. Distance Vector Multicast Routing Protocol (DVMRP) tunneling interconnects 2 multicast-enabled networks across non-multicast networks.
9. IEEE 802.1x allows dynamic, port-based security, providing user authentication.
10. IEEE 802.1x with VLAN assignment allows a dynamic VLAN assignment for a specific user regardless of where the user is connected.
11. IEEE 802.1x and port security are provided to authenticate the port and manage network access for all MAC addresses, including that of the client.
12. Port-based ACLs for Layer 2 interfaces allow security policies to be applied on individual switch ports.
13. VLAN trunks can be created from any port, using either standards-based 802.1Q tagging.
14. 4000 VLAN IDs are supported.
15. IGMP snooping provides fast client joins and leaves of multicast streams and limits bandwidth intensive video traffic to only the requestors.
16. Shall support Uni-cast routing protocol RIP v2.
17. Shall support Protocol Independent Multicast (PIM).
18. 32-Gbps switching fabric.
19. Electrical Specifications:
    a. PoE Support: 375 watts available for 24 ports with PoE+, 195 watts available for 24 ports with PoE.
20. Ethernet switches shall be as manufactured by Cisco or HP.

G. Equipment Racks
1. Division 28 Contractor shall provide one (1) – 19" LCD monitor at each NVR rack location to be able to view NVR/VMC/VI server(s) display. Monitor shall be rack mounted.
2. Division 28 Contractor shall provide combination keyboard/monitor shelf at each NVR location.
3. Division 28 Contractor shall provide a mounted KVM Switch and all required cables and power supplies when more than one NVR is installed in a rack location. KVM capacity shall support connection of all NVRs in a rack location.

4. All CCTV equipment is to be furnished with UPS backup per the UPS specification section. This includes PoE Ethernet Switch power. All 120 VAC camera circuits shall be connected to an emergency power circuit.
5. Top and bottom shall be 14-gauge steel, horizontal braces shall be 16-gauge steel welded to integral structural side panels of 16-gauge steel
6. Shall be fully enclosed and provided with front door, rear door, side panels and top panel with cooling fans.
7. Cooling fans shall be provided in a capacity to fully exhaust the heat dissipated by the equipment.
8. Rack shall come equipped with two pairs of 11-gauge steel rackrail with tapped 10-32 mounting holes in universal EIA spacing.
9. Contractor to provided 6 RU of blank space at the top to be enclosed using rack blank panels.
10. There shall be no spacing between components within the rack.
11. Equipment racks shall be Middle Atlantic Products or Atlas Soundolier.

H. Camera Poles:
1. The heavy-duty pole is for exterior applications and is designed to be weatherproof against the outdoor environmental element effects of discoloration and as well shall be designed to meet or exceed the local requirements for wind load resistance. The installer shall be responsible for checking the local codes for compliance.
2. The poles staff shall be round and extruded from all new 6063 alloy aluminum tubing and heat-treated to produce a T6 temper. The pole shaft shall be 6” in diameter by 18 feet tall non-tapered and shall be of one-piece seamless construction. Shafts with seams welded or not will not be acceptable.
3. The pole shaft shall be continuously welded to a 12” base plate. The base plate shall be cast from A356 aluminum alloy and tempered to Aluminum Association T6 standards.
4. The anchor bolts shall be fabricated from structural quality, hot rolled carbon bar, having a minimum yield strength of 50,000 PSI. The anchor bolts shall be an “L” design and shall be galvanized.
5. An extruded handhole to provide for internal wiring shall be provided and shall have a cover with tamper resistant security screws.
6. The unit shall be designed and manufactured to allow the conduit and wiring to be totally concealed and run within the unit.
7. The unit shall be finished in a standard dark bronze (DB) powder coating. Other finishes are available.
8. Concrete Mounting Base;
9. The pole shall mount to a round concrete base. The concrete base will be furnished under the General Construction Contract.
10. Poles shall be United Lighting Standards or approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer’s product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.
B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.
C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of two (2) years from the date of substantial completion.

END OF SECTION 280300 – June 17, 2024

SECTION 280400 - WATCH TOUR SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Watch Tour System equipment as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional Watch Tour System.

B. Related Sections:

1. Section 11190 Detention Equipment
2. Section 260000 Electrical
3. Section 280000 Security Electronics, General
4. Section 280110 Graphic Control Panels
5. Section 280120 Touch Screen System
6. Section 280140 Programmable Logic Controller

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Included under this Section of the work shall be the furnishing, installation, connection and testing of the complete Watch Tour System including, but not limited to, watch tour stations and printers.

B. Major Sub-systems include:

1. Programmable Logic Controllers (PLC's).
2. Touch Screen Control Stations.

1.04 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.
2. Submit plan drawings showing location and mounting of each watch tour station.

1.05 DESCRIPTION

A. The functions as described in 280120 Touch Screen System shall be affected by the inputs from the individual watch tour stations.

B. The PLC shall be the basis of control for the watch tour station inputs.
C. Watch tour functions and activities shall be printed to the system alarm printer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following listed manufacturers, subject to compliance with the specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this specification.
B. Watch Tour Stations:
   1. Shall be operated by a momentary contact key switch.
   2. Shall have an 11 GA. Stainless faceplate mounted to a single gang rough-in box.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.
B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.
C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280400 – June 17, 2024

SECTION 280500 - VEHICLE DETECTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide Vehicle Detectors equipment as specified herein and as shown on the drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional Vehicle Detection System.

B. Related Sections:

1. Section 260000 Electrical
2. Section 280000 Security Electronics, General
3. Section 280120 Touch Screen System
4. Section 280140 Programmable Logic Controller
5. Section 280200 Intercommunications System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Included under this Section of the work shall be the furnishing, installation, connection and testing of the complete Vehicle Detection System including.

B. Major Sub-systems include:

1. Programmable Logic Controllers (PLC's).
2. Touch Screen Control Stations.
3. Intercommunications System.

1.04 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.
2. Submit plan drawings showing location and mounting of each vehicle detector.

1.05 DESCRIPTION

A. Vehicle detectors shall be furnished and installed at locations as shown on the drawings. Exact location of the detector shall be as recommended by the manufacturers of the vehicle detector.

B. It shall be responsibility of the Division 28 Contractor to extend relay contact circuits and to furnish and install any vehicle detector interface that may be required. Relay contact rating shall be compatible with system requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following listed manufacturers, subject to compliance with the specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this specification.

B. Buried Sensor:

1. Sensor system shall consist of a sensor pre-assembled to a direct burial cable, and a processor board.
2. Processor board shall be mounted in the nearest PLC equipment cabinet.
3. The system shall be solid state with isolated relay outputs to perform the functions noted in the specifications.
4. Sensitivity adjustment of the system shall be accomplished by a single tuning operation at the processor board.
5. The circuits shall be optimized for lighting protection including sensor, line and ground circuits.
6. System shall be furnished complete with power supplies and protection fuses.
7. Technical specifications for the vehicle detector shall be as follows:
   a. Power Input: 12VAC or 14 VDC
   b. Current Requirement: 100 mA maximum
   c. Output Relay Rating: 3 Amp SPDT
   d. Timed Output: 1 or 7 seconds
   e. Operating Temperature: 0 to 120° (Processor), -30 to 150° (Sensor).
   f. Vehicle detector shall be Cartell Model CT-2B or approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.

B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.

C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.

B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280500 – June 17, 2024

SECTION 28 05 08 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Product Data: For ground rods.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

1. Apache Grounding/Erico Inc.
2. Boggs, Inc.
3. Chance/Hubbell.
4. Copperweld Corp.
6. Erico Inc.; Electrical Products Group.
7. Framatome Connectors/Burndy Electrical.
8. Galvan Industries, Inc.
9. Harger Lightning Protection, Inc.
10. Hastings Fiber Glass Products, Inc.
14. Kearney/Cooper Power Systems.
15. Korns, C. C. Co.; Division of Robroy Industries.
18. O-Z/Gedney Co.; a business of the EGS Electrical Group.
19. Raco, Inc.
22. Superior Grounding Systems, Inc.
23. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

K. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

N. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Bolted type.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 3/4 by 8’0”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders and branch circuits.
2. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
3. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
4. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install an insulated equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
5. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
6. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
7. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
8. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, 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.

    a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
    b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

G. Metal Frame Grounding for Buildings: Drive a ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart. Connect rod to column with an underground grounding conductor. Use tinned-copper conductor not less than No. 2/0 AWG for underground conductor, and bury 18 inches (450 mm) below grade, minimum.

H. Ground Rods: 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.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

I. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

J. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

K. Metal Water Service Pipe: Provide 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

L. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

M. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

N. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

O. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
9. Tighten screws and bolts for grounding and bonding 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.
10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81. If more than 25 ohms provide additional work to get to 25 ohms.
3. Provide drawings locating each ground rod, 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. Nominal maximum values are as follows:

    a. Equipment Rated 500 kVA and Less: 10 ohms.
    b. Equipment Rated 500 to 1000 kVA: 5 ohms.
    c. Equipment Rated More Than 1000 kVA: 3 ohms.

END OF SECTION – June 17, 2024

SECTION 280710 - UNINTERRUPTIBLE POWER SYSTEM (UPS)

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide UPS equipment as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional UPS system.

B. Related Sections:

1. Section 11190 Detention Equipment
2. Section 260000 Electrical
3. Section 280000 Security Electronics, General
4. Section 280120 Touch Screen System
5. Section 280140 Programmable Logic Controller
6. Section 280200 Intercommunications System
7. Section 280300 IP CCTV

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. 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.

C. Underwriter's Laboratories (UL)

1. UL 508 Industrial Control Equipment
2. NEC National Electrical Code (latest edition)

1.03 WORK INCLUDED

A. Furnish all materials and services as required to provide back up UPS power to the Division 28 systems.

1.04 APPROVALS

A. General

1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.
2. Load summary for each UPS panel. Load summary shall identify the actual measured loads or calculated loads for each specific load. Loads shall be based on equipment to be furnished and installed.

1.05 DESCRIPTION

A. The primary function of the uninterruptible power system (UPS) is to ensure that critical security electronics and communications systems elements remain operational and without errors caused by power line disturbances or interruptions.

B. All doors and gates, except vehicle gate operators, shall be powered from the UPS distribution system. This does not include power to door locks. All other Division 28 equipment shall be powered from the UPS power source. This includes but is not limited to, PLC and relay equipment, intercom equipment, CCTV equipment, including camera power, control room equipment including monitors, keypads, computers, graphic control panels and video visitation equipment.
C. Each UPS system shall include conductors, make-before-break bypass switch, UPS unit, batteries and power distribution panel. Conductors shall be sized compatible with the unit furnished. Unit shall be sized for the connected load, plus a 20% reserve. Batteries shall be sized for 10 minutes of run time at 100% loading.
D. Distribution Panels: Division 28 shall furnish the UPS Distribution Panels for installation by the Division 16 Electrical Contractors for each UPS system required by the project. Division 16 contractor shall extend conduits and circuits to equipments requiring UPS power. Division 28 contractor shall provide electrical power distribution drawings for location of UPS power receptacles and junction boxes and to identify the UPS power source from which the load is supplied. UPS load summaries shall include all UPS loads.

PART 2 - PRODUCTS

2.01 MATERIALS

A. UPS System:
1. Each UPS unit shall be sized as described herein.
2. Supply voltage to the UPS shall be either 120 or 208 volt, single phase, 60 Hz. Division 28 shall provide and install dry- type transformers for 208 volt single phase supplies to create the conversion to the required 240 UPS input.
3. Division 28 shall provide over-current protection per the NEC.
4. Each UPS shall be equipped with a make-before-break external by-pass switch with AC disconnect.
5. Output voltage shall be 120V, single phase, 60Hz.
6. UPS alarm output shall be provided to interface with the alarm reporting system as described in Section 280110 Graphic Control Panels and/or 280120 Touch Screen System. UPS alarms for power transfer to the UPS system shall not report to Master Control as an alarm for conditions where the transfer to UPS power is less than one (1) minute.
7. Units shall equipped with sealed batteries.
8. UPS systems shall be Liebert UPStation S Series, Best Ferrups or approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.

B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.04 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.05 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280710 – June 17, 2024

SECTION 28 08 00 - SURGE PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Applicable requirements of the General Conditions and Special Conditions/Requirements shall be considered a part of this section and shall have the same force and effect as if specified herein.
B. The work included under this section consists of the installation i.e., labor, materials, supervision to install, calibrate, adjust and check-out the total Lightning/Surge Protection System.
C. The system shall be in accordance with ANSI/IEEE Standards C62, 41-1980 and C62, 45-1987.
D. All A/C surge protection devices shall have the lowest surge voltage rating per UL1449-1991 that is consistent with line levels.
E. Submit complete shop drawings on equipment and installation.

1.02 ACCEPTABLE MANUFACTURERS

A. Ditek, Clearwater, FL
B. Northern Technologies, Inc., Spokane, Washington
C. Transtector, Idaho

1.03 WARRANTY

A. Product shall be warranted for a period of not less than five (5) years.

PART 2 - PRODUCTS

2.01 LOCKING CONTROL CIRCUITS

A. Primary suppression modules shall be composed of pure silicon avalanche diodes only.
B. Silicon avalanche diodes shall be bi-polar and bi-directional, incorporate no switching components and meet the following requirements:
    1. Silicon avalanche diodes shall be of grade A +/- 5%.
    2. Silicon Avalanche diode manufacturer shall be product list 19500, DESC & JANS certified.
C. Shall have an initial clamping voltage suitable to the application and shall not exceed 200% of the peak signal voltage rating for the device.
D. Shall have a peak clamping voltage suitable to the application and shall not exceed 300% of the peak signal voltage rating for the device.
E. Shall be selected as required for the particular data frequency and signal level characteristics of the application.
F. Total system response time not to exceed 5 nanoseconds.

2.02 DATA AND SIGNAL

A. Primary suppression modules shall be composed of pure silicon avalanche diodes only.
B. Shall have a surge life of at least 10 operations for 10,000 amp, 8 x 20 microsecond wave.
C. Shall have an initial clamping voltage suitable to the application and shall not exceed 200% of the peak signal voltage rating for the device.
D. Shall have an peak clamping voltage suitable to the application and shall not exceed 300% of the peak signal voltage rating for the device.
E. Shall be selected as required for the particular data frequency and signal level characteristics of the application.
F. Total system response time not to exceed 5 nanoseconds.

2.03 COMMUNICATION LINES

A. Shall incorporate silicon avalanche diode devices as the primary protection means with the following characteristics:
   1. Up to 150v signal line voltage
   2. 200v peak clamping voltage
B. Total system response time not to exceed 5 nanoseconds.

PART 3 EXECUTION

3.01 GROUNDING

A. All equipment shall be grounded in accordance with the NEC, these specifications and drawings, and the equipment suppliers recommendations.
B. Power ground systems and signal ground system shall remain physically separated throughout the facility.
C. Each equipment cabinet shall be bonded directly to a driven signal ground rod system, and grouped cabinets shall be bonded together and connected to a single point on the driven signal ground rod system.
D. Cable shields shall be grounded at one end only. Grounding shall be at the low level end of the signal line.

3.02 SURGE PROTECTION

A. All metallic data, communications, video, and sensor lines entering or leaving a building shall be protected with surge protection devices.
B. Grounding of protection devices shall be in accordance with the manufacturers recommendations and/or as described in these specifications.
C. All signal line protective devices shall be located at the terminal point nearest the cable interface with the exterior cable plant. Devices shall be mounted to the back panel of the cabinet.
D. Verify power panel boards for locking equipment have panel board protectors.
E. Where locking equipment is fed from a panel board not protected by a panel board protector, provide a branch circuit protector installed at the panel board.

3.03 GROUND RESISTANCE MEASUREMENT

A. Each signal ground system D.C. resistance shall be measured between any point on the signal ground bus and the earth ground.
B. An instrument designed specifically to measure the resistance of a point to each earth ground shall be used. The security contractor shall measure ground resistance in accordance with the procedure as outlined by the test equipment manufacturer. Instrument shall be biddle earth resistance test instrument.

END OF SECTION – June 17, 2024

SECTION 28 09 00 - WIRING METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section of the specifications requires the complete installation of all raceway systems for the Electronic Security systems. Conductors used for electronic signal transmission are specified with the specific equipment or systems in other sections of this division of the specifications.

B. The work shall consist of the installation of a complete wiring and conduit system for the Electronic Security system of insulated conductors installed in a raceway system.

C. Conductor sizes for wiring specified or indicated on the drawings are based on copper conductors; **aluminum conductors are not acceptable.**

D. Location of all components of the Electronic Security systems indicated on the drawings are approximate unless specific dimensions are shown. Components shall be located for proper use of the device with consideration given to other equipment to be installed in the immediate vicinity.

E. Material provided under this section of the specifications shall be new and shall be manufactured and tested in accordance with the following standards.
1. NEMA - WC-5-1973 Thermoplastic Insulated Wires
2. NEMA - TC-2 Schedule 40 PVC
3. UL.6 - Rigid Galvanized Steel Conduit
4. UL.797 - Electrical Metallic Tubing
5. UL.1 - Flexible Steel Conduit
6. ANSI - C-33.80 1971 Thermoplastic Insulated Wires
7. ANSI - C-80-1 Rigid Galvanized Steel Conduit
8. ANSI - C-80-3 Electrical Metallic Tubing

1.02 WIRING SYSTEMS

A. Power wiring for motor operated solenoid operated lock sets operating at 120 volts shall be No.l4 THWN or XHHW. Motor operated and solenoid operated lock sets operating at 24 volts AC or DC shall be connected with No. 16 MTW conductors. Power wiring for electric operated, motor driven, sliding gates and doors shall be provided under Division 16 - Electrical.

B. All wiring for status pilot lamps shall be class one signalling circuits as defined by Article 725 of the National Electrical Code, 1981 Edition. All conductors shall be No. 16 MTW and shall be installed in common raceways and equipment enclosures with other conductors for locking devices within limitations defined by Article 725-15 of the National Electrical Code.

C. All wiring systems shall be stranded copper conductors.

D. All wiring systems shall be color coded. White or grey conductors are used only for neutral conductors and green only for grounding conductors.

E. All conductors within junction boxes, pull boxes and equipment enclosures shall be grouped and laced with nylon tie straps with identification tab, in individual sets serving individual lock sets or operating mechanisms. Conductor groups shall be identified on the strap tab with respect to room or operator served.

F. Locking system conductors shall not be spliced; conductors shall be continuous between lock sets and/or operators and termination point.

G. All underground and underslab conductors shall be rated for direct burial.

H. The Contractor shall prepare a "full size" drawing showing all components located inside the locking relay cabinet. The drawing shall be on malar with indelible ink medium. It shall be mounted on foam board and mounted using a wooden frame on the electronic room wall. It shall show wiring (identifying colors), fuses, relays (cells numbers or otherwise), status, commons, group functions, power supplies, etc. It shall be submitted to the engineer for approval near the completion of the project. All field changes must be reflected on this drawing.

1.03 CONDUIT SYSTEMS

A. Raceway system within secured areas, i.e., areas accessible to inmates shall be concealed unless specifically indicated on the drawings or specified herein to the contrary.

B. Refer to Division 16, "Conduit and Raceways" for specific conduit requirements.

1.04 JUNCTION BOXES

A. Junction boxes and pull boxes required for the installation of the locking system wiring must be installed to be fully accessible as required by the National Electrical Code.

B. Junction boxes and pull boxes shall not be installed in areas normally accessible to inmates.

C. Where junction or pull boxes area installed outdoors, boxes shall be cast metal type with conduit hubs as required, flush mounted, checkerboard type cover held in place with brass screws and full neoprene gasket. Box shall be classified as NEMA-4 watertight. Box shall be set in concrete with concrete dimensions exceeding box dimensions by not less than three inches on all sides and bottom.

1.05 PULL BOXES AND JUNCTION BOXES

A. Pull boxes and junction boxes shall be installed where indicated on the drawings and where required to facilitate the installation of conductors.

B. Pull boxes and junction boxes shall be installed to be fully accessible as required by the National Code.

C. All pull boxes and junction boxes installed in interior spaces shall be constructed of code gauge galvanized sheet steel of the dimensions required by Article 370-18 of the National Electrical Code.

D. Pull boxes and junction boxes installed exposed to the weather shall be cast metal boxes and blank cover gasket with hubs as required by the number and position of conduits entering each box.

1.06 AUXILIARY RELAYS

A. Auxiliary relays shall be provided where necessary to interface systems specified in this Division of the specifications, i.e., lighting circuit, television circuits, solenoid valve, etc.
   1. Auxiliary relays shall be general purpose, glass enclosed socket type with 24V/120V control coil, unless other voltage is indicated. Relays shall be rated for continuous duty. Operating voltage range shall not be less than +10% - -15% of nominal voltage. All relays shall be provided with manual override operator. Contact arrangement shall be four pole double throw for each relay. Number of relays required to obtain control sequence indicated on control wiring diagram shall be provided. When required relay function exceeds three pole contact arrangement, one contact of initial relay shall be used to control coil of second relay. Sockets with screw type terminals rated at ten amps shall be provided for each relay.

1.07 AUXILIARY CABINETS

A. Auxiliary cabinets shall be provided where necessary to house auxiliary control system component such as power supplies, control power transformers and auxiliary relays.

B. Auxiliary cabinets shall be surface mounted constructed of code gauge steel, and finished on all surface with rust inhibiting prime coat and two coats of flat medium grey enamel paint. Panel shall contain hinged door and flush mounted lock and latch. Panel depth shall not exceed 5-3/4 inches.

C. All wiring within auxiliary cabinet shall be grouped and laced with nylon tie straps, and terminated on identified terminal blocks. Wiring shall comply with the "WIRING SYSTEMS" section of these specifications. All conductors shall be terminated with crimp type lugs on both sets of terminal blocks.

1.08 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-A document, manufacturer's recommendations and best industry practices.
B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.
C. All labels shall be clear with black text.
D. All cables shall be labeled with machine generated, wrap around labels.
E. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet' 12" from termination block/patch panel.
F. Labeling scheme shall be alphanumeric.

END OF SECTION – June 17, 2024

SECTION 283111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions, SCAR and Electrical sections apply to work specified in this section.

1.2 RELATED WORK AND REQUIREMENTS

A. Conduits
B. Wire, Cable, and Connectors
C. Boxes
D. Supporting Devices
E. Grounding

1.3 QUALITY ASSURANCE

A. Installation shall be in accordance with the drawings, specifications and the following:

1. NFPA 70 – National Electrical Code
2. NFPA 72 –National Fire Alarm Code
3. NFPA 101 – Life Safety Code
4. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems
5. NFPA 13 – Standard for the Installation of Sprinkler Systems
6. Americans with Disabilities Accessibility Guidelines
7. ASME A17.1 – Elevator Code
8. Approval from the Office of the State Fire Marshal
9. State Requirements for Educational Facilities (SREF)

B. All wiring and installation shall comply with NFPA 70. Recommendation by manufacturer's documentation for wiring requirements for shielding certain conductors from others or routing in separate raceways shall be followed provided it does not violate NFPA 70.

C. System, including all components, shall be listed by Underwriters Laboratories, Inc. (UL) for the fire protective signaling purpose for which used.

1. UL 864/UOJZ, APOU Control units for Fire Protective Signaling Systems

2.	UL 268	Smoke Detectors for Fire Protective Signaling Systems
3.	UL 268A	Smoke Detectors for Duct Applications
4.	UL 521	Heat Detectors for Fire Protective Signaling Systems
5.	UL 228	Door Holders for Fire Protective Signaling Systems
6.	UL 464	Audible Signaling Appliances
7.	UL 1638	Visual Signaling Appliances
8.	UL 38	Manually Activated Signaling Boxes
9.	UL 346	Waterflow Indicators for Fire Protective Signaling System
10.	UL 1971	Standard for Signaling Devices for the Hearing Impaired
11.	UL 1481	Power Supplies for Fire Protective Signaling Systems

D. System equipment to be of one manufacturer and be supported by a factory-trained, established service organization of equipment manufacturer who shall stock parts for equipment supplied.

E. Equipment shall be manufactured by a firm who has been actively manufacturing fire alarm systems for a minimum of 7 years and offer a three-year warranty on all control equipment.

1.4 CONTRACTOR QUALIFICATIONS

A. Installer Qualifications: Contractor directly responsible for this work shall be a systems contractor, who is and who has been regularly engaged in the furnishing and installation of commercial and industrial fire alarm systems of this type and size for at least the immediate past five years. All equipment shall be installed by a senior technician located within 100 miles of project site and trained by the equipment manufacturer or a recognized training school or course for the installations of this type system. The contractors shall employee and utilize on this project a NICET level IV systems designer in fire protection engineering technology fire alarm systems and a NICET level III site project manager in fire protection engineering technology fire alarm systems. The contractor shall, if requested by the engineer, show proof of a specific individual's qualifications and training. The system contractor shall directly employ a suitable number of skilled systems installers whose normal work is systems installation and who shall install and make the wire and cable connections thereto.

B. As part of the project submittal, it shall be demonstrated to the satisfaction of the engineer that the systems contractor has adequate facilities and equipment to do the work properly and expeditiously, adequate staff and technical experience.

1.5 SUBMITTALS

A. Shop Drawings

1. Submittal shall include complete schematic circuit diagrams for system and include all equipment, wiring diagrams showing connections between all system components, descriptions of system operation, annunciator schedule showing titles for each zone, and manufacturer's literature marked to show model and catalog number for all equipment. The submittal shall include substantiating emergency (battery) and normal power supply calculations for supervisory and alarm power requirements and calculations of notification appliance circuit loading (end of circuit voltage drop) to ensure proper operation of all appliances. Complete riser diagrams for system indicating wiring sequence of all alarm devices and control equipment shall be included with submittal data. Submittals shall be as a complete set; partial submittals will not be acceptable. Electrical drawings shall not be on less than 8-1/2" by 11" sheets and shall identify all symbols used. The complete control panel schematic, including all modules if so constructed, shall be on a single sheet drawing with all circuit terminals and interconnections identified. Include the following:

    a. Data sheets for every device used on this project.
    b. Specification sheets on all wiring including fiber optic wiring.

2. This is an existing facility. As part of the shop drawings the contractor shall provide existing conduit layouts and existing device layouts. The contract drawings show existing conditions and may be used for shop drawings.
3. Seismic Qualification Certificates: For fire alarm control unit, accessories, and components, from manufacturer. Entire system must comply with OSHPD or equal performance under special seismic certification OSP-0031-10.

    a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
    c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. The contractor shall provide the Engineer with three bound copies of the following, to be forwarded to the Owner at completion of project:

1. As-built wiring and conduit layout diagrams showing all fire alarm devices on floor plans, including wire color code and terminal numbers, and showing all interconnections in the system.
2. Electronic circuit diagrams of all FACP modules, power supplies, annunciator, data gathering panels, addressable interface modules, etc.
3. Technical literature on all major parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Receive equipment at jobsite; verify applicable components and quantity delivered per invoice.
B. Handle equipment to prevent internal components damage, breakage, denting, and scoring enclosure and finish.
C. Do not install damaged equipment.
D. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris, and physical damage.
E. After installation, protect from damage by work of other trades.

1.7 GENERAL

A. Furnish and install a complete point addressable intelligent Fire Alarm System as described herein and as shown on the plans. The system shall provide Style B initiating device circuit supervision, individual indicating appliance circuit supervision, control circuit supervision, incoming and standby power supervision. Include control panel, manual pull stations, automatic fire detectors, audio visual alarm signal devices, remote control devices, all wiring installed in conduit, connection to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.
B. The fire alarm control panel shall allow for loading or editing special instructions and operating sequences as required. The system is to be capable of onsite programming to accommodate and facilitate expansion, building parameter changes or changes as required by local codes. All software operations are to be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the system programs stored in memory.
C. The ability for selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations is to also be incorporated in the resident software programming of the system.
D. To accommodate and facilitate job site changes, initiation circuits shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.
E. All control equipment shall have transient protection devices to comply with UL864 requirements.
F. Control panel shall accept addressable analog detectors and addressable monitor modules for dry contact devices. The input power shall be 120 volt A. C., 60 Hz., three wire, individually fused per NEC Article #760 or NFPA Standard. The operating power shall be a single power source of 24 volts D. C. at 4 amps, filtered and regulated within 110% of the normal rating. The control panel shall be double supervised on the input power line with automatic switchover to battery backup. The battery backup supply shall be the type that will provide at least 24 hours of the supervisory current.

G. After 24 hours, the battery backup supply shall be capable of energizing all signal devices for a period of at least five minutes. In addition, the low battery backup supply monitor shall supervise and automatically sound System Trouble in the event that a trouble occurs in the system (i.e., the batteries being disconnected or discharging to 85% of full charge). Battery and power supply capacity shall provide an additional 25% spare capacity for additional alarm signal devices that may be added to the system.

H. Bypass switches shall be included for system testing to prevent audible/visual signal operation, HVAC control activation, and remote fire department notification. Bypass switches for fire alarm system testing shall be located in main fire alarm control panel. Activation of bypass switches shall cause system trouble alarm.

I. Fire alarm system wiring shall be as follows: initiating device circuits - Style B; network data line circuits - Style 7: indicating appliance circuits - Style Y; analog device loops - Style 4.

1.8 SYSTEM OPERATION

A. Upon activation of the Fire Alarm System by any smoke detector, duct detector, sprinkler flow alarm switch, or other automatic detection device located on or serving a floor, the following shall occur, in addition to the above in Paragraph A:

1. Shut down all air handling systems and exhaust fans serving that floor.
2. Close all smoke dampers in ducts associated with the air handling units and exhaust fans that are shut down.

B. Upon activation of the Fire Alarm System by a manual station, smoke detector, duct detector, sprinkler flow alarm switch or other automatic detection device, the following shall occur:

1. Energize all audible alarm signaling devices. Audible signal shall be temporal type as required by NFPA 72.
2. Flash visual signals throughout the building.
3. Send signal to central monitoring station via Digital Alarm Communicator (DACT).
4. Cause device to be displayed on the annunciator section of the control panel and remote annunciator via LCD display.
5. Close all doors held open by magnetic door holders.

C. Upon activation of the Fire Alarm System by a duct smoke detector, the following shall occur in addition to the above:

1. Shut down associated air handling system.
2. Close all smoke dampers in ducts associated with the air handling unit.

D. Smoke dampers in ducts shall close whenever associated air handling system is shut down either by fire alarm system activation or otherwise.

E. Trouble on any of the fire alarm wiring shall cause a display of that zone at the fire alarm control panel and remote annunciator and shall indicate a trouble condition.

F. Sprinkler tamper switches shall be displayed individually at the fire alarm control panel and remote annunciator as a supervisory alarm. When the tamper switch is activated, a distinctive audible signal shall occur at the fire alarm control panel (the audible signal shall be different than that for the fire alarm zone trouble alarms). Operation of the tamper switch shall not affect the operation of the sprinkler system flow/pressure switches and shall not sound the general alarm.

G. An alarm pilot light on each smoke detector activated shall illuminate.

H. Elevator Control - upon activation of elevator lobby, hoistway or machine room smoke detector, phase 1 elevator recall shall be initiated. Upon activation of heat detector(s) in elevator hoistway or machine room, power to the elevator(s) shall be disconnected prior to the application of water.

I. System installation shall allow remote restarting of all air handling systems after having been shut down by the Fire Alarm System. Air handling systems shall automatically restart after fire alarm system has been reset.

1.9 SYSTEM REQUIREMENTS

A. The Fire Alarm System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:

1. Modular systems design.
2. All System operational software is to be stored in FLASH EPROM memory. Control Panel disassembly, and replacement of electronic components of any kind shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes.
3. Advanced Windows™-based System Definition Utility with Program Version Reporting to document any and all changes made during system start-up or system commissioning. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data.
4. System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.

B. The Fire Alarm System shall include the following features and shall support the following operations in each installed cabinet or node of the system:

1. Up to 10 Intelligent Device loops.
2. Up to 250 Intelligent Devices per loop.
3. Up to 1000 Manual Control (Input) Switches
4. Up to 2000 LED Annunciation Points

5. Up to 63 Remote Display Units.
6. Ground fault detection by panel and by device module.
7. Ability to download all system applications programs and "firmware" from a computer through a single point in the system.
8. True Distributed Intelligence, including microprocessor-based Detectors and Modules.
9. A.C. Power Trouble Delay adjustable from 1 minute to 12 Hours.
10. Removable, Interlocked terminal blocks for the connection of the field wiring to the Fire Alarm Control Panel.
11. Electronic Addressing of Field Devices.
12. Advanced Power Management
13. Dead Front Construction

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included here.

1. EST
2. NOTIFIER
3. FIRE CONTROL INSTRUMENTS

2.2 GENERAL

A. Use of a manufacturer's name and model or catalog number is for purpose of establishing standard of quality, general configuration, and operating characteristics desired only. This specification is intended to be a minimum standard for function, operation and performance. Equipment catalog numbers are listed for EST to establish this minimum. Listed suppliers of equal equipment shall bear the cost of any changes to plans and specifications due to said equipment.

2.3 CONTROL PANEL

A. The fire alarm control panel shall be EST Model EST3, surface mounted.
B. The Fire Alarm/Control Panel shall include an Emergency Operators' Interface Panel which shall include the following system annunciation and control functions:

1. System Annunciation and Control Functions:

a. Hands free Emergency Operation. The last highest priority event on the system shall be displayed automatically.
b. Control Panel Internal Audible Signal shall have four programmable signal patterns, to allow for the easy differentiation between Alarm, Supervisory, Trouble and Monitor conditions within the installed system.

2. Discreet “System Status” LEDs:

a. Power Status LED - Green LED shall illuminate when AC power is present.
b. Test Status LED - Yellow LED shall illuminate when any portion of the system is in the test mode. A programmable timer shall cause the system to automatically exit the test mode after a period of system inactivity. This Test LED shall function in a local or in a group mode.
c. CPU Fail Status LED - Yellow LED shall illuminate when the panel controller has an internal failure.
d. Ground Fault Status LED - Yellow LED shall illuminate when un-grounded wiring connected to the cabinets’ power supply has continuity to ground. This feature shall function in either a local or group mode.
e. Disable Status LED - Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.

3. Discreet Common Control Switches with associated Status LEDs:

a. Reset: Depression of the Reset Switch starts the system reset operation. The associated Yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to normal mode. Each phase, as well the overall reset cycle shall be programmable to perform other functions.
b. Alarm Silence: Depression of the Alarm Silence Switch shall turn off all (audible and/or visible) Notification Appliance Circuits. The associated yellow LED illuminates when the Alarm Silence function is active, whether by the Alarm Silence Switch, or by an integral software timer. Subsequent activation of the Alarm Silence Switch shall resound the signals. Activation of the Alarm Silence switch shall be programmable to perform other functions.
c. Panel Silence: Depression of the Panel Silence Switch shall turn off the systems’ internal trouble audible signal. The associated yellow LED illuminates when the panel silence feature is activated. Panel audible signal shall have user programmable signal rates for alarm, supervisory and trouble conditions.

d. Drill Switch / LED: Depressing the DRILL switch activates the fire drill function. Yellow LED indicates that the fire drill function is active. The Drill Switch shall also be programmable to perform system functions other than the Drill Function.

C. Control panel shall be provided with a 168 character Liquid Crystal Display (LCD).

1. The Liquid Crystal display shall provide the means to inform the System Operator with detailed information about the off-normal status of the installed Fire Alarm System. The Main Display shall automatically respond to the status of the system, and shall display that status on an 8 line by 21 character backlit alpha-numeric Graphical Liquid Crystal Display.
2. Automatic Functions:

a. The following status functions shall be annunciated by the Main Liquid Crystal Display:
b. When the Fire Alarm System is in the "Normal" Mode, the LCD displays:

1) The current Date and Time.
2) System status, i.e., Normal.
3) Custom name, two lines.
4) Alarm history.

c. With the Fire Alarm System in the Alarm Mode, the LCD shall automatically display the following:

1) Systems Status Line

The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD Display.

2) Current Event Window

The LCD shall show the last active event of the highest priority to highlight the condition to the Emergency Operator. The second and third lines shall display an identification message related to the displayed event.

3) Last Event Window
4) Type Status Window

3. System Message Processing:

a. In order to simplify, and to clarify the System Status information which is given to the Emergency Operator, the Main LCD shall include prompts for each of the System Event Types. The Main LCD shall allow the

Emergency operator access to the System Status information by pressing an associated select switch. Whenever there is an unacknowledged event in any of the System Event prompts, the associated Status LED shall flash.

b. All messages contained in any of the System Event queues shall be accessible for review by the Emergency Operator using the "Previous/Next" message switch. It shall be possible to route additional event information to a printer.

4. Maintenance Menu:

a. The Main LCD shall also allow the System Operator to access system maintenance functions through a four level password system. The authorized System Operator shall be able to access the following functions:

b. System Status

The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.

c. Enable

The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system.
Additionally, the system shall allow the operator to restore any group function, guard patrol function, Panel, system module, "software - defined zone", operator control, or time control function.

d. Disable

The system shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system.
Additionally, the system shall allow the operator to disable any group function, guard patrol function, Panel, system module, "software - defined zone", operator control, or time control function within the system.

e. Activate

The system shall allow the operator to manually turn on any system output point, or system function. Alternate Smoke Detector sensitivity, message routing within the system, guard patrol timing, and check-in group timings shall be modifiable with this simple command from the control panel.

f. Restore

The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the

message routing functions with this simple command from the control panel.

g. Control Output

The system shall allow the operator to manually command and control relays and LEDs. Relays shall be able to be commanded to “Latch”, to energize as a “High Priority”, or as a “Low Priority”, to “Energize”, or to “De-Energize”.
LEDs shall be able to be commanded to “Latch”, to energize as a “High Priority”, or as a “Low Priority”, to turn “On“, to turn “Off”, to “Slow Blink”, or to “Fast Blink”.

h. Reports

The system shall provide the operator with system reports which give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD, and shall be capable of being printed on any of the connected system printers.

1) The system shall provide a report which gives a sensitivity listing of all detectors.
2) The system shall provide a report which provides a sensitivity listing of any particular detector.
3) The system shall provide a report which gives a chronological listing of up to the last 650 system events.
4) The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

i. Program

The system shall allow the authorized operator to perform all of the following system functions:

1) Set the System Time
2) Set the System Date
3) Set (Change) the System Passwords.
4) Restart the System.
5) Set the Dates for the System Holiday Schedule.
6) Clear the Chronological System History File.

j. Test

The system shall allow the authorized operator to perform test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per cabinet, circuit, or service group basis.

D. Graphic Command Workstation

1. The graphical command workstation shall function as a UL listed coordination and display center for all operational and administration functions required for the fire alarm systems furnished under this specification. The graphical workstation shall provide primary control of the fire systems supplied under this specification. It is the intent of this specification that a single workstation shall receive, view, and record system events for each fire alarm system supplied furnished under this specification.
2. The workstation shall utilize an industrial grade personal computer that is listed to the following UL standards:

    a. UL Standard 365 (*Police Station Connect*) category APAW
    b. UL Standard 864 (Control Units for Fire-Protective Signaling Systems) categories UOJZ and APOU.
    c. UL Standard 1610 (Central-Station Burglar-Alarm Units) category AMCX

3. The workstation computer shall provide a minimum of a 3.2 GHz Pentium 4 Processor with a 800 MHz front side bus, 512 MB RAM, 120 GB Hard Drive, and 19" touch screen LCD monitor. The computer shall be configurable for desktop, floor, or rack mounting. The workstation operating system shall be Windows XP®.
4. The workstation monitor shall be a 19” (diagonally) color LCD touch screen display. The display shall provide 1280 x 1024 resolution. The display shall be UL-864 listed for fire applications. The monitor shall be capable desktop or rack mount.
5. The graphics work station shall support up to eight (8) direct serial data connections and 800 LAN/WAN connected fire alarm networks. The serial data connection between the graphics work station and directly wired FACPs shall be a single supervised circuit.
6. The graphics work station shall act as a server to simultaneously communicate the status of all systems connected to the graphics work station to up to fifteen (15) remote PCs running graphics client software over the owner’s data network or VPN. Clint software shall actively poll the graphic work station server to determine event status. All event changes shall be automatically announced on the client PC. No operator interaction shall be required to retrieve or display incoming events. It shall be possible to filter events displayed on the client by event type. Web browser technology shall not be considered as equal. All workstation to client communications shall be encrypted for privacy.
7. Graphic Workstation Software

a. The graphic display screen shall organize and structure system events for easy user comprehension. The workstation display(s) shall simultaneously present a combination of up to six (6) event driven information areas or (window) panes. Available panes shall include an event list pane, a map pane, an event action pane, a camera pane, a browser pane, and an image pane, as described below.

b. The "event list pane" shall display the address of alarm and off-normal points with type, description, and time of the event in a prioritized color-coded event list. When the operator highlights an event in the event list pane, the system shall automatically focus on this event and command the other panes to display information related to the selected event; presenting all available event information panes to the operator.

c. The "event action pane" shall provide operator controls for alarm silence, alarm acknowledgement, drill, and alarm system reset. The "event action pane" shall provide event counters detailing of the number of active events on all systems connected to the graphical workstation. The "event action pane" shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator's log shall be provided to record the operator's comments for each event in system history with time and date.

d. The "map pane" shall automatically display color graphical representation of the area location in which the alarm or off-normal device is located. Devices shall be represented by dynamic Icons. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered as equal.

e. The perimeter of the area on the map containing the active device icon shall flash in a color keyed to event type. Different colors shall be provided for the following events: alarm, trouble, supervisory, security, disabled, restore. Operator acknowledgement of an event shall cause the flashing perimeter to light steadily. It shall be possible to quickly click and jump to additional maps providing additional details about the device initiating the event. The map shall support touch sensitive areas to permit operators to initiate programmed system functions. It shall be possible to import graphic images in the following formats to create event maps: dwg, dxf, wmf, tif, and rle.

f. The "image pane" shall display a stored image associated with the event focused upon in the event list pane. The image pane shall be capable of displaying photographs (.jpg), videos (.mpg, AVI), bitmaps (.bmp), and CAD (.dxf, .dwg) files.

g. The “camera pane” shall be capable of displaying CCTV images in response to event preset commands sent to the CCTV system. The “camera pane” shall be capable of controlling camera operations including PTZ, focus, and iris settings.

h. The image and camera panes shall work interchangeably, depending on the stored or real-time images programmed for event highlighted in the event list pane.
i. The “browser pane” shall be capable of displaying a World Wide Web page in response to the event focused upon in the event list pane.
j. The graphic workstation shall be capable of individually filtering events displayed by the workstation, sent to the workstation printer, and sent to the history file. Filters shall be provided for alarm, supervisory trouble, and monitor events, as well as security, test, and disabled points.

8. Workstation Operation

a. Operators shall be required to log on the workstation using a user ID and password in order to access all workstation functions. Each user shall have individually configurable privileges as assigned by the system administrator.
b. When an event is received at the graphic workstation, it shall be prioritized on the event list pane as well as log the event to history. The highlighted event shall command all other configured workstation panes to display information relevant to the event in focus, as described in the software paragraphs above.
c. Receipt of an event shall activate an audio WAV file over the workstation speakers alerting the operator to an incoming event.
d. Receipt of an event shall send a preprogrammed email messages in response to any system event via an SMTP mail server.
e. Receipt of an event shall print the event graphics on a laser printer.
f. For each fire alarm panel/network directly connected to the workstation, the operator shall be capable of operating all fire alarm panel functions including acknowledging, silencing, and resetting each panel as well as manually activating, deactivating, enabling, and disabling individual fire alarm points on each panel.
g. For each fire alarm panel/network connected directly or via LAN/WAN to the workstation, the operator shall be capable of initiating and receiving panel generated status, sensitivity, and maintenance reports.
h. It shall possible to search across multiple workstation history files and print desired report information. It shall be possible to run reports automatically as defined by a report schedule.

E. Signature Device Cards (3-SDC)

1. The Signature Device Card 3-SDC shall be the interface between the Fire Alarm Control Panel and the Signature Series Detectors and Modules. Provide quantity as required. Allow for 25% future growth on each card.

2. The communications format between the 3-SDC and the Signature Series Devices shall be 100% digital. Communications to devices must incorporate BROADCAST POLLING and DIRECT ADDRESS SEARCH to ensure the fastest reporting of off-normal conditions to the system human interface layer.
3. It shall be possible to wire the 3-SDC as Class A (Style 6 or Style 7) or Class B (Style 4) without twisted or shielded wire. It must be possible to wire branch circuits (T-Taps) from Class B Circuits.
4. The associated controller, through the 3-SDC, shall provide the ability to set the sensitivity and alarm verification of each of the individual intelligent detectors on the circuit. It shall be possible to automatically set the sensitivity of individual intelligent detectors during day and night periods.
5. It shall be possible for the 3-SDC to address all intelligent devices connected to it without having to set switches at the individual devices.
6. It shall be possible to obtain a mapping report of all devices connected to the circuit for confirmation of "as-built" wiring. The map shall show physical wiring of T-Taps, device types, and the panel addresses of devices connected to the circuit. The 3-SDC shall be capable of reporting unexpected additional device addresses and changes to the wiring in the data circuit. A specific trouble shall be reported for any off-normal non-alarm condition.
7. The SDC shall be able to report the following information on a per intelligent device basis:

    a. Device Serial Number
    b. Device Address
    c. Device Type
    d. Current Detector Sensitivity Values and the Extent of Environmental Compensation.
    e. Any of 32 possible trouble codes to specifically diagnose faults.

8. Should a Signature Driver Controller CPU fail to communicate, the Signature circuit shall go into the stand-alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand-alone mode.

F. Provide power supply and battery capacity for system operation. Power supply and battery capacity shall be sized to allow an additional 25% spare capacity for future growth. The power supply shall be able to perform an automatic load test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range. Power supplies shall incorporate the ability to adjust the charge rate of batteries based on ambient temperatures.

G. Digital Alarm Communicator Transmitter

1. Provide a digital dialer (digital alarm communications transmitter (DACT)) module to transmit all alarms, supervisory and trouble signals individually to a Central Monitoring Station (CMS).
2. The DACT shall be V.32bis 14.4K baud full duplex modem and support two telephone lines. The modem shall permit upload and download of system data remotely via a telephone line. Shall be able to transmit network status information to CMS via telephone. Four DACT protocols shall be available. Shall be EST Model 3-MODCOM.

2.4 INTELLIGENT MANUAL STATIONS

A. Addressable Manual Fire Alarm Stations shall be non-break glass type, providing non-coded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of high impact, flame retardant plastic, with operating directions provided on the cover in highlighted, embossed lettering. The words "PULL IN CASE OF FIRE" shall appear on the door in embossed letters one-half inch high or larger. The stations shall be mounted directly to a standard single gang box, 2 1/2 inches deep. Manual Stations shall be listed by Underwriters Laboratories. Shall be EST Model SIGA-278.

B. Shall be semi-flush mounted 48" AFF to center of device.

2.5 INTELLIGENT PHOTOELECTRIC SMOKE DETECTORS

A. The intelligent analog photoelectric detector shall use a light scattering type photo sensor to detect visible particulate produced by combustion. The photoelectric detector shall utilize an integral micro-processor to dynamically examine values from the sensor and initiate a system alarm based on the analysis of that data. Systems which use a central processor to monitor the signals from a circuit of analog sensors to detect a fire will not be accepted.

B. The photo detector shall continually monitor itself for any changes in sensitivity due to the environmental effects of dirt, smoke, temperature and humidity. The information shall be stored in the detector and transferred to the Signature Loop Controller for retrieval at any time.

C. The photoelectric smoke detector shall be suitable for both area and air duct applications. The detector shall be listed for direct installation in ducts up to 3 feet high and 3 feet wide and air velocities up to 5000 ft./min. (0-25.39 m/sec.) without requiring a special housing or sampling tubes. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%.

D. The photo detector shall be suitable for operation in the following environment:

1. Temperature: 32 F to 120 F (0 C to 49 C)
2. Humidity: 0-93% RH, non-condensing
3. Elevation: no limit

E. The photo detector shall be listed for a minimum linear spacing of 30 feet. It shall be suitable for ceiling or wall mounting.

F. Each detector shall revert to Intelligent Analog Conventional operation when it detects a failure of the Signature Loop Controller.

G. Shall be EST Model SIGA-PS. Provide Model SIGA-SB base for mounting detector. Provide Model SIGA-RB relay type base where required i.e. for elevator recall. Provide Model SIGA-AB4G sounder base where required for residential units operating as an independent local alarm, or part of a zone or system alarm with synchronized audible output.

2.6 INTELLIGENT DUCT SMOKE DETECTORS

A. Provide smoke detector duct housing assembly EST Model SIGA-DH to facilitate mounting an intelligent analog photoelectric detector, EST Model SIGA-PS, along with a standard relay or isolator detector mounting base. Provide for variations in duct air velocity between 300 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube which extends the entire width of the duct. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Finish the housing in baked red enamel.

B. Provide a remote indicator alarm for each duct detector. Shall be EST Model SIGA-LED. Mount on ceiling in corridor nearest to duct detector location. Mount on flush single gang box.

2.7 INTELLIGENT HEAT DETECTORS

A. Heat detectors shall be analog addressable type. Combination fixed temperature/rate-of-rise heat detectors shall be EST Model SIGA-HRS and fixed temperature heat detectors shall be EST Model SIGA-HFS. Heat detector shall have a nominal fixed temperature alarm point rating of 135 F. Provide auxiliary contacts rated 120 VAC for control of elevator shunt trip breaker.

2.8 VISUAL SIGNAL DEVICES (STROBES)

A. Strobes shall be self-synchronized to flash at 1 fps across their full operating voltage range. Strobes shall operate on any existing 2-wire signal circuit, providing the wire is code approved. Strobes shall provide a synchronized flash rate. Strobes shall be synchronized without the use of “synch control modules”. All strobe models shall provide “Equivalent Facilitation” allowed under ADA Accessibility Guidelines and Satisfy NFPA codes. Strobes shall have a “distributed” light output pattern and be UL 1971 listed as Signaling Devices for the Hearing Impaired. Strobes shall have field selectable candela settings of 15, 30, 75 and 110 candela. Strobes shall be set at 15 candela, unless otherwise noted on drawings. System battery and power supply capacity shall be based on all strobes set at the 110 candela rating. Strobes shall be EST Model GI-VM (white color). Flush wall mount 80” AFF to bottom of strobe.

2.9 AUDIO VISUAL ALARM SIGNAL DEVICES

A. Units shall be of the combination type, with an electronic horn and flashing strobe light contained within the same housing. In-Out screw terminals shall be provided for wiring. The horn/strobe shall have a white plastic housing. Horn/strobes shall be selectable for high

or low dBA output. Selection of low or high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible. A synchronized temporal pattern sound output level of 97 dBA average shall be provided. Horn shall have field selectable high and low db output.

B. The strobe shall provide field selectable synchronized flash outputs of 15, 30, 75 or 110 candela. The strobe shall have housing markings for wall mounting.

C. Horn/strobes shall be EST Model GI-HDVM (white color). Flush wall mount 80" AFF to bottom of device.

2.10 HARST ENVIORNMENT AUDIO VISUAL SIGNAL DEVICES

A. Provide red electronic horn/strobes at the locations shown on the drawings. Horns shall be temporal output. At the high output setting, the horn shall provide a 85 dBA continuous sound output or a 95 dBA temporal sound output, when measured in reverberation room per UL-464. Strobes shall provide 15 cd, 75 cd, 110 cd synchronized flash outputs without the use of separate “synchronizing” modules. The strobe shall have lens markings oriented for wall or ceiling mounting.

B. In - Out screw terminals shall be provided for wiring. Horns shall mount to a North American 4” electrical boxes (2-1/8” deep) or to a 2-gang (2-3/4” deep) electric box. Weatherproof wall boxes shall be provided for outdoor applications.

C. Provide EST model 757 series.

2.11 AIR HANDLING SYSTEM SHUTDOWN RELAYS

A. Provide and install a supervised addressable output relay at each Air Handling System for shutdown on alarm from fire alarm system as per system operation description. The unit shall be normally closed with a coil to match voltage of Fire Alarm Control Panel and interrupt starting circuit of Air Handling System unit fan(s). Shall be Air Products Corp. Model PAM-1. Use with EST control relay module SIGA-CR. Provide and install a supervised addressable output relay at each exhaust fan for shutdown on alarm from fire alarm system as per system operation description, unless exhaust fan is interlocked with AHU.

2.12 WATERFLOW DETECTOR/PRESSURE SWITCHES

A. Waterflow or pressure switches to be supplied and installed by the fire protection system contractor and wired to the Fire Alarm System by this Contractor. Provide EST Model SIGA-WTM water flow/tamper module.

2.13 SPRINKLER SUPERVISORY SWITCHES

A. Supervisory switches to be supplied and installed by fire protection system contractor and wired to the Fire Alarm System by this Contractor. Activation of switch shall cause supervisory alarm to be displayed at fire alarm control panel. Provide EST Model SIGA-WTM water flow/tamper module.

2.14 SINGLE INPUT MODULES

A. Provide intelligent single input modules EST Model SIGA-CT1 as required. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The single input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches).

2.15 DUAL INPUT MODULES

A. Provide intelligent dual input modules EST Model SIGA-CT2 as required. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The dual input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches)

2.16 MONITOR MODULES

A. Provide intelligent monitor modules EST Model SIGA-MM1 as required. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit.

2.17 CONTROL RELAY MODULES

A. Provide intelligent control relay modules EST Model SIGA-CR as required. The Control Relay Module shall provide one form “C” dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

2.18 DOOR HOLDER/RELEASE

A. Electromagnetic door holder/releases shall be flush wall mounted and installed on each door as indicated on the drawings and/or as specified herein. Holder/release shall consist of a wall mounted electromagnet and a door mounted armature with an adjustable contact plate. Electromagnets shall have a force of attraction of 24 pounds when energized and less than 3 pounds residual power disconnected. Armature contact plates shall have a horizontal adjustment of 25 degrees. The holding force of holder/releases shall be totally electromagnetic and without the use of mechanical linkage or other moving parts. All

holder/releases shall normally be energized, and a release shall be accomplished by interrupting the circuit.

B. Operating voltage of holder/releases shall be 24 volt D.C. Shall be EST Model 1504AQ.

2.19 REMOTE ANNUNCIATORS

A. Provide flush wall mounted remote LCD annunciators as indicated on drawings, which will indicate each addressable device. Alarm, supervisory and trouble conditions will also be indicated via LED. These conditions will have dedicated acknowledge buttons. Operation of the appropriate acknowledge button silences the tone alert. A 168 character, back-lit, alpha-numeric, liquid crystal display will provide clear English language information as to the fire alarm point status (alarm, trouble, etc.), type of alarm (smoke detector, pull station, etc.),number of alarms, supervisory conditions and troubles, and a custom location label. Annunciator shall display first and last alarm hands-free. The operator shall be able to scroll forward or backward through all historically logged abnormal conditions. Shall be EST Model 3-LCDANN series. Flush wall mount 5'-0" AFF.

B. The remote annunciators shall be powered by the fire alarm control panel.

2.20 PROTECTIVE DEVICE COVERS

A. Install painted 14 ga. painted steel mesh protective cover over all devices such as smoke detectors, heat detectors, etc. Steel shall be 1/8 inch thick, with sufficient openings to allow normal flow of smoke and air. The steel mesh shall be welded to a square 14 ga. steel frame with two (2) mounting holes on each side. The cover shall be secured to the ceiling with tamper-proof screws. Protective covers shall be UL listed for use with the devices being protected. All protective covers for all fire alarm devices shall be new.

2.21 SPARE PARTS

A. The contractor shall provide five (5) of each device specified here-in unless otherwise listed below:

1. One (1) fire alarm panel
2. One (1) remote annunciator

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall be a Certified Alarm System Contractor I or Certified Unlimited Electrical Contractor, as described in Florida Statutes 489, Part II, and Florida Department of Professional Regulations.

B. The addressable fire alarm system shall be connected, programmed, and tested only by the manufacturer or by an authorized distributor who stocks a full compliment of spare parts for the system. Technicians performing this service shall be trained and individually certified by the manufacturer for the model of system being installed. Copies of their certifications must

be included with the contractor's submittal to the engineer, prior to installation. The submittal cannot be approved without this information.

C. Power for Fire Alarm Panel shall be 120 V A.C., 60Hz.

D. Power conductors shall be minimum #12. Both power wires and circuit breaker shall be rated to the current requirements for the system.

E. Indicate the maximum current requirements on the system submittal drawings.

F. All fire alarm system wiring shall be per manufacturer's recommendations and shall meet requirements of Article 760 of the National Electrical Code. All wiring shall be installed in conduit.

G. Provide 25% spare capacity on each signal circuit so that additional signal devices can be added.

H. The FAC and other panels shall be mounted with sufficient clearance for observation and testing. All junction boxes that are visible or accessible shall be painted red, unless in finished areas. All wiring shall be installed in conduit. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduit, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to insure positive grounding throughout the entire system.

I. No wiring other than that directly associated with fire alarm or auxiliary fire protection functions shall be permitted in fire alarm conduits. There shall be NO splices in the system other than at terminal blocks. "Wire nuts" and crimp splices are NOT permitted. Permanent wire markers shall be used to identify all terminations for each circuit. For splices, use markers or other means to indicate which conductor leads to the FACP. All connections shall be made on terminal strips. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. No more than two conductors under one connection. Wire on these terminals shall be labeled. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

J. All wiring shall be color coded in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:

1.	Initiating Circuits	Yellow(+)/Brown (-)
2.	Alarm Indicating Appliance Circuits	Red(+)/Blue (-)
3.	AHU Shutdown Circuits	Orange
4.	Door Control Circuits	Gray
5.	Elevator Capture Circuits	Violet

a. Exception: Addressable initiating circuits shall comply with Paragraph K, Below.

K. Wire shall be 14 AWG minimum, stranded or solid copper, type THHN or THWN except for addressable loop controller circuits. Addressable loop controller circuits are to be wired with type FPL/FPLR/FPLP fire alarm cable, solid copper, AWG 18 minimum, twisted pair, installed in conduit, instead of AWG 14 THHN/THWN stranded (solid)conductors. Provide shielded cable if required by manufacturer. If shielded cable is required by manufacturer, cable shield drain wires are to be connected at each device on the loop to maintain continuity, and taped to insulate from ground. Terminate the shield at the FACP in accordance with the manufacturer's instructions. The cable shall have red jacket, with yellow (+) and brown(-) conductors. Cable shall be equal to West Penn 980.

L. All addressable loop controller circuits shall have a minimum of 25% spare addresses for future use. "T" taps from the loop are permitted, but only if they serve no more than 30 initiating devices and/or control points, in an area which does not exceed approximately half of one story. To minimize the impact of a wiring fault on the system, isolation modules must be provided as follows:

1. After each 30 devices/control points on any addressable circuit, including taps.
2. At each "T" tap which feeds 5 or more devices/control points.
3. For each circuit extending outside the building.
4. All isolation modules must be clearly labeled, readily accessible for convenient inspection, and shown on the as-builts.

M. Initiating device or indicating appliance circuits must not be included in raceways containing AC power or AC control wiring. Within the FAC panel, any AC control wiring must be properly separated from other circuits. The enclosure must have an appropriate warning label to alert service personnel to the hazard.

N. A unique identification number shall be assigned to each detector. (Identification shall be by zone number and device number within the zone.) This number shall be noted on the submittals and as-built plans, and also be permanently mounted adjacent to the detector or affixed to its base.

O. The system shall be provided with the following protective devices to prevent damage of nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. They are to be provided by the fire alarm equipment supplier:

1. On AC Input: Ditek DTK-120HW or DTK-120/240 CM, EFI HWM-120, Leviton OEM-120EFI, Transtector ACO100BWN3, or equal UL Listed device approved by NCDoI. Installed at the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns of about 1" diameter, and tie-wrapped.
2. On DC circuits Extending Outside Building: Adjacent to the FACP, and near the point of entry to the outlying building, provide a "pi" filter on each leg. This consists of a primary arrestor, a series impedance of 1 millihenry or more, and a fast acting secondary arrestor which clamps between 30 and 40 volts. Acceptable

models with these or equivalent features include Simplex 2081-9027 and 2081-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel American B280 -24V, Edco P264 and P642, or equal. Submit specification on other candidate suppressors for approval.

P. Control wiring to the air handling shutdown relays shall be supervised from the fire alarm control panel to the relay coil per NFPA 101, Chapter 7-6.5.5. Locate shutdown relay within 3 feet of air handling unit motor starter.

Q. Area smoke detectors shall be located a minimum of three feet from HVAC supply diffusers and return air openings.

R. Descriptive display of all addressable devices at fire alarm control panel. LCD shall include smoke compartment in which device is located.

S. Provide monitoring of the following fire pump alarms:

1. Pump running
2. Loss of power in any phase
3. Phase reversal alarm on line side of motor starter
4. Controller connected to alternate source
5. Isolating switch opening
6. Wire the above indicated alarms to the fire alarm system for annunciation as a supervisory alarm.

3.2 SYSTEM TESTING AND CERTIFICATION

A. Upon completion of the installation, the contractor and the manufacturer’s authorized representative together shall test every alarm initiating device for proper response and zone indication, every alarm signaling appliance for effectiveness, and all other functions such as elevator capture and control of smoke doors/dampers, HVAC systems, and pressurization fans. All supervised circuits must be also tested to verify proper supervision. (Note that control circuits and remote annunciation lines are among those required to be supervised.)

1. Note: The Engineer must be given advance notice of the tests, so that he and/or the Owner may witness them if desired.

B. Smoke Detector Sensitivity Report:

1. A test shall be performed on each ceiling, room and duct type smoke detector in accordance with the manufacturer's instructions. The sensitivity of each smoke detector shall be determined in accordance with NFPA-72 requirements. A certification report signed by the installing contractor shall be submitted after the testing, listing each smoke detector and the test method used to obtain the manufacturer's calibrated sensitivity.

C. Differential Pressure Test:

1. A test shall be performed on each duct mounted smoke detector indicating the quantity of air passing over the respective duct mounted smoke detector in feet per minute. (Measuring pressure drop for detectors using sampling tubes is also an acceptable method.) A certification report signed by the installing contractor shall be submitted after the testing, listing each duct mounted smoke detector, the test equipment and method used.

D. The Contractor shall submit the following test documentation:

1. Written verification that this 100% system test was done.
2. Measured sensitivity of each smoke detector.
3. NFPA 72 "Fire Alarm System Certification and Description" Form.

E. After successful completion of inspection and test, the warranty period begins. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt and effective corrective action. The Owner may require a repeat of the Contractor's 100% system test. Continued unacceptable performance during the warranty period shall be cause to require the Contractor to remove the system.

3.3 SYSTEM DOCUMENTATION, TRAINING AND MAINTENANCE

A. The contractor shall provide the Engineer with three bound copies of the following, to be forwarded to the Owner:

1. As-built wiring and conduit layout diagrams, including wire color code and terminal numbers, and showing all interconnections in the system.
2. Electronic circuit diagrams of all FACP modules, power supplies, annunciator, data gathering panels, addressable interface modules, etc.
3. Technical literature on all major parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.

B. The manufacturer's authorized representative shall instruct the Owner's designated employees in proper operation of the system and in all required periodic maintenance. This instruction will include 2 copies of a written, bound summary, for future reference.

1. NOTE: Basic operating instructions shall be framed and mounted at the FACP. Also, to facilitate maintenance, provide engraved label inside the FACP indicating the location and identification of panelboard and circuit supplying 120 vac to the system.

C. The Contractor shall have the manufacturer's authorized representative provide a quotation for regular preventive maintenance, in accordance with the requirements of NFPA 72. This will cover the first 12 month period after expiration of the one year warranty.

3.4 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864 and UL 2572.

B. Technical Support: Beginning with Substantial Completion, provide software support for five years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within five years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.5 WARRANTY

A. All equipment and systems shall be warranted by the contractor for a period of three years (3) following the date of final acceptance and shall include damage due to surges from lightning or electrical utility. The warranty shall include parts, labor, prompt field service, pick-up and delivery.

END OF SECTION – June 17, 2024

SECTION 311000 - SITE CLEARING

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

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
2. Division 2 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
3. Division 2 Section "Landscaping" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section C, General Conditions of the Project Manual.

1.7 PROJECT CONDITIONS

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

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer.

C. Salvable Improvements: Carefully remove items indicated to be salvaged, if any, and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earth Moving."

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

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

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

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

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Erosion, Sedimentation & Pollution Control (ESPC) Plan.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

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

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.

4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
1. Replace trees that cannot be repaired and restored to full-growth status, as determined by Landscape Architect or Engineer.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

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

1. Arrange with utility companies to shut off indicated utilities.

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

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

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

E. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and stockpile in areas approved by Engineer for reuse as mulch. Dispose of excess mulch off-site.

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

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

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

1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

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

1. Limit height of topsoil stockpiles to 10 feet.
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.
5. Topsoil shall be re-spread at a minimum depth of 4 inches and shall be mechanically screened to remove rocks greater than 1” in any direction, roots, trash and other deleterious debris.

3.7 SITE IMPROVEMENTS

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

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

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

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING

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. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for concrete walks.
4. Subbase and base course for asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling for utility trenches.
7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:
1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
4. Division 2 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

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

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

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

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

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or blasting, when permitted:

1. Mass Rock Excavation: Any material that cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a draw bar pull rated at not less than 120,000 pounds (Caterpillar D-9N or equivalent) or by a Caterpillar 973 front-end loader or equivalent.
2. Trench Rock Excavation: Any material, which cannot be excavated with a backhoe having a bucket curling force rated at not less than 42,000 pounds (Caterpillar Model 235C or equivalent).
3. Rippable Rock: Any material that does not meet the requirements of mass rock or trench rock excavation shall be considered rippable rock. Rippable rock is considered to be general earthwork as structural fill. Removal of rippable rock shall be included as part of the base bid and shall not apply to any allowance.
4. General: Material that can be excavated without continuous drilling, ram hammering, or blasting will not be classified as Rock Excavation. Material not classified as rock, in accordance with definitions contained herein, shall be excavated in accordance with this Section.

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

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

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

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Geotextile.

B. Samples: 12-by-12-inch (300-by-300-mm) Sample of separation geotextile.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

D. Blasting Plan: For record purposes; approved by authorities having jurisdiction.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.5 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

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

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

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

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

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

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.

5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

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

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

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system, specified in Division 2 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives unless approved by the Owner and the Engineer. Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. 6 inches beneath bottom of concrete slabs on grade.
    e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

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

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

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

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

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

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase and base course to required crown elevations and cross-slope grades.
3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.

4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Design Professional will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

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

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

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

3.20 PROTECTION

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

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

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

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

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 construction dewatering.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Division 2 Section "Excavation Support and Protection."
3. Division 2 Section "Earth Moving" for excavating, backfilling, site grading and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design**,** furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
4. Remove dewatering system if no longer needed.

1.4 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written report outlining control procedures to be adopted if dewatering problems arise.
3. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

D. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.

1. Note locations and capping depth of wells and well points.

E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

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

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 60 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner

that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 OBSERVATION WELLS

A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated and additional observation wells as may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION 312319

SECTION 313116 - TERMITE CONTROL

PART 1 GENERAL

1.01 GUARANTEE

A. Furnish the Using Agency a written five-year guarantee. The guarantee shall state that the application was made by a licensed professional pest control operator at the concentration, rates and methods, which comply with this section. Retreatment upon evidence of subterranean termite activity shall be at no charge to the Owner or the Using Agency. Damage to the building caused by termites shall be corrected without cost to the Owner or the Using Agency.

PART 2 PRODUCTS

2.01 MATERIALS

A. Any termiticide approved by EPA and State of Georgia. Application and concentration shall be in accordance with label instructions.

PART 3 EXECUTION

3.01 TIME OF APPLICATION

A. Do not begin work until all preparations for slab placement have been completed, except vapor barrier.

B. Do not apply termite treatment soil poison when surface water is present.

3.02 LOCATION

A. Apply treatment to all areas beneath concrete floor slabs-on-grade or fill, and along the interior sides of all foundation walls and grade beams. Where the exterior is abutted by concrete slabs or asphalt paving, treat the exterior sides of foundation walls and grade beams as specified herein for interior sides of such walls.

3.03 RATE OF APPLICATION

A. Apply treatment at the minimum rate of 1 gallon of toxicants to each 10 square feet under slabs-on-grade within the building lines.

B. Treat the voids of masonry foundation walls at the rate of 1 gallon per 5 lineal feet.

C. Apply treatment at the rate of 2 gallons per 5 lineal feet at the following areas:

1. Immediately below expansion joints, control joints and all areas where slab will be penetrated by construction features.
2. Where exterior facings or veneers extend below grade level along the exterior side of all foundation walls, or where unit masonry foundation construction is used.

END OF SECTION 313116

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

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 temporary excavation support and protection systems.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Division 2 Section "Dewatering" for dewatering excavations.
3. Division 2 Section "Earth Moving" for excavating and backfilling and for existing utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

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

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

SECTION 321313 - CONCRETE PAVING

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.

B. SC DOT Standards & Specifications, latest edition.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Curbs and gutters.
3. Walkways.
4. Medians.

B. Related Sections include the following:

1. Division 2 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a radius 100 feet or less.

B. 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.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place.

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

2.4 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

2.5 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

3.5 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 follow recommendations in ACI 305R for hot-weather protection during curing.

3.6 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.7 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.

3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated, and corrective procedures shall be provided for protecting and curing in-place concrete.
9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, 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.

D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

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. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:
1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

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. Crafco Inc., an ERGON company; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

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. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

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. Crafco Inc., an ERGON company; Superseal 444/777.

B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

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. Meadows, W. R., Inc.; Sealtight Hi-Spec.
b. Right Pointe; D-3405 Hot Applied Sealant.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Chain-link fences.
   2. Gates: Motor operated, horizontal slide and manual swing.

B. Related Sections:
   1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and post footings.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
   1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 3.66 m (12 feet) high, and post spacing not to exceed 3 m (10 feet).

C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Fence and gate posts, rails, and fittings.
   2. Chain-link fabric, reinforcements, and attachments.
   3. Gates and hardware.
   4. Gate operators, including operating instructions.
   5. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
   1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
   1. Gate hardware.
   2. Gate operator.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.01 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Mini Mesh for Mezzanine Balcony:
   a. Steel Wire Fabric: Wire with a diameter of 0.075 inch, 14 gauge
   b. Mesh Size: 16mm (5/8 inch)
   c. Zinc-Coated Fabric: ASTM A 392, Type II
   d. Coat salvage ends of fabric is metallic coated before the weaving process with manufacturer's standard clear protective coating.
3. Steel Wire Fabric: Wire with a diameter of 0.120 inch.
   a. Mesh Size: 50 mm (2 inches).
   b. Zinc-Coated Fabric: ASTM A 392, Type II.
   c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
4. Selvage: Twist at both selvages.

2.02 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.
   a. Line Post: 60 mm (2.375 inches) in diameter.
   b. End, Corner and Pull Post: 102 mm (4.0 inches).
3. Horizontal Framework Members: top rails complying with ASTM F 1043.
   a. Top Rail: 42 mm (1.66 inches) in diameter.
4. Metallic Coating for Steel Framing:
   a. Type A, consisting of not less than minimum 0.61-kg/sq. m (2.0-oz./sq. ft.) average zinc coating per ASTM A 123/A 123M or 1.22-kg/sq. m (4.0-oz./sq. ft.) zinc coating per ASTM A 653/A 653M.
   b. Coatings: Any coating above.

2.03 TENSION WIRE

A. Metallic-Coated Steel Wire: 4.5-mm- (0.177-inch-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type II, zinc coated (galvanized) with the following minimum coating weight:
   a. Matching chain-link fabric coating weight.

2.04 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single swing gate types.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: As indicated.

B. Pipe and Tubing:
1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 300 mm (12 inches) to attach barbed wire assemblies.

E. Hardware:
1. Hinges: 180-degree swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate except where electric lock is indicated.
3. Electronic Lock: Specified with security hardware with control as indicated on ES drawings.

2.05 HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F 1184 for gate posts and single sliding gate types.
1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
a. Gate Frame Width and Height: As indicated.

B. Pipe and Tubing:
1. Zinc-Coated Steel: Protective coating and finish to match fence framing.
2. Gate Posts: Comply with ASTM F 1184. Provide round tubular steel posts.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 300 mm (12 inches) as required to attach barbed wire assemblies.

E. Hardware:
1. Hangers, roller assemblies, and stops fabricated from galvanized steel.

2.06 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.
1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 152 mm (6 inches) long.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 50 mm (2 inches) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts; for each post unless otherwise indicated, and as follows:
   1. Provide line posts with arms that accommodate top rail or tension wire.
   2. Provide corner arms at fence corner posts, unless extended posts are indicated.
   3. Type I, single slanted arm.

I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
      a. Hot-Dip Galvanized Steel: 2.69-mm- (0.106-inch-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

J. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 366 g /sq. m (1.2 oz. /sq. ft.) zinc.

2.07 BARBED WIRE

A. Steel Barbed Wire: Comply with ASTM A 121, for two-strand barbed wire, 2.51-mm- (0.099-inch-) diameter line wire with 2.03-mm- (0.080-inch-) diameter, four-point round barbs spaced not more than 127 mm (5 inches) o.c.
   1. Zinc Coating: Type Z, Class 3.

2.08 BARBED TAPE

A. Unreinforced tape: 301 Series stainless steel hardened to Rockwell (30N 45 to 50, 0.025 inch (0.64mm) thick by 1.2 inch (30.7 mm) wide before fabrication; with 4-point, needle-sharp barbs.
B. Clips: Stainless steel.
C. Tie Wires: Stainless steel.
D. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379.
   1. Coil Loop Spacing(s): Manufacturer’s standard.

2.09 GATE OPERATORS

A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
   1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
   2. Provide operator with UL -approved components.
   3. Provide electronic components with built-in troubleshooting diagnostic feature.
   4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
B. Comply with NFPA 70.
C. UL Standard: Fabricate and label gate operators to comply with UL 325.
D. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor.

Comply with NEMA MG 1 and the following:

1. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
2. Horsepower: Manufacturer's standard.
3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 40 deg C (105 deg F) and at altitude of 1005 m (3300 feet) above sea level.
5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

E. Gate Operators: Equipment base/pad mounted and as follows:

1. Mechanical Slide Gate Operators:
   a. Duty: Medium duty, commercial/industrial.
   b. Gate Speed: Minimum 18.2 m (60 feet) per minute.
   c. Maximum Gate Weight: 363 kg (800 lb).
   d. Frequency of Use: 25 cycles per hour.
   e. Operating Type: Wheel and rail drive.

F. Remote Controls: Provide for control as indicated on ES drawings

G. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

H. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

I. Operating Features:

1. System Integration: With controlling circuit board capable of accepting any type of input from external devices.

2.10 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 152.5 m (500 feet) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
1. Install fencing on established boundary lines inside property line.

3.04 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
a. Concealed Concrete: Top 50 mm (2 inches) below grade to allow covering with surface material.
b. Posts Set into Voids in Concrete: Form or core drill holes not less than 125 mm (5 inches) deep and 20 mm (3/4 inch) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. Posts at Balcony: Set post at maximum 10’ oc. Post shall extend from balcony floor to anchorage at ceiling. At bottom weld post to balcony. At top provide positive anchor thru gypsum drywall to metal framing above.

D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

E. Line Posts: Space line posts uniformly at 3 m (10 feet) o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 1830 mm (72 inches) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 3.05-mm- (0.120-inch-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 610 mm (24 inches) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
   1. Extended along bottom of fence fabric. Install bottom tension wire within 152 mm (6 inches) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Install and secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to enclosing framework. Leave 50 mm (2 inches) between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 380 mm (15 inches) o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Extend the wires 360° around supports, through the mesh and twist ends together three complete turns.
   1. Maximum Spacing: Tie fabric to line posts at 300 mm (12 inches) o.c. and to braces at 610 mm (24 inches) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

N. Barbed Wire: Install barbed wire uniformly spaced , angled toward public side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

O. Barbed Tape: Install per manufacturer’s instructions.

P. Bolts shall be pinged or spot welded so as to be unremovable.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Equipment Bases/Pads: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

C. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.07 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 450 m (1500 feet) except as follows:
   1. Fences within 30 m (100 Feet) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 225 m (750 feet).
      a. Gates and Other Fence Openings: Ground fence on each side of opening.
         1) Bond metal gates to gate posts.
         2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 460 mm (18 inches) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 45 m (150 feet) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 150 mm (6 inches) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
   1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
   2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.08 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
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. Lubricate hardware, gate operator, and other moving parts.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 329000 - LANDSCAPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work consists of furnishing and installing all planting materials required for landscaping hereinafter specified in locations as shown.

1.2 EQUIPMENT

Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

1.3 SUBMITTALS

A. Certificates of Conformance or Compliance: Before delivery, notarized certificates attesting that the following materials meet the requirements specified shall be submitted to the Engineer for approval:

1. Plant Materials (Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease).
2. Fertilizers.
3. Lime
4. Peat
5. Seed
6. Sod
7. Membranes
8. Asphalt Adhesive

B. Manufacturer's Literature and Data:

1. Metal edging
2. Antidesiccant
3. Erosion control materials
4. Hydro mulch
5. Pre-emergent herbicide

1.4 DELIVERY AND STORAGE

A. Delivery:

1. Notify the Contractor or Engineer of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant material from the job site immediately.
2. Protect plants during delivery to prevent damage to root balls or desiccation of leaves. Protect trees during transport by tying in the branches and covering all exposed branches.
3. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.
4. Deliver fertilizer and lime to the site in the original, unopened containers bearing the manufacturer's warrantee chemical analysis, name, trade name or trademark, and in conformance to state and federal law.
5. During delivery: Protect sod, from drying out and seed from contamination.

B. Storage:

1. Sprinkle sod with water and cover with moist burlap, straw or other approved covering, and protect from exposure to wind and direct sunlight. Covering should permit air circulation to alleviate heat development.
2. Keep seed, lime, and fertilizer in dry storage away from contaminants.
3. Store plants not installed on the day of arrival at the site as follows:
   a. Shade and protect plants from the wind when stored outside.
   b. Heel in bare root plants.
   c. Protect plants stored on the project from drying out at all times by covering the balls or roots with moist sawdust, wood chips, shredded bark, peat moss, or other similar mulching material.
   d. Keep plants, including those in containers, in a moist condition until planted, by watering with fine mist spray.

1.5 PLANTING AND TURF INSTALLATION SEASONS AND CONDITIONS

A. Perform planting operations when season is acceptable for growing. Refer to the grassing chart for types of seed to plant during the current growing season.

B. No work shall be done when the ground is frozen, snow covered, too wet or in an otherwise unsuitable condition for planting. Special conditions may exist that warrants a variance in the specified planting dates or conditions. Submit a written request to the Engineer stating the special conditions and proposal variance.

1.6 PLANT AND TURF ESTABLISHMENT PERIOD

A. The Establishment Period for plants and turf shall begin immediately after installation, with the approval of the Engineer, and continue until the date that the Owner accepts the project or phase for beneficial use and occupancy. During the Plant and Turf Establishment Period the Contractor shall:

1. Water all plants and turf to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 1 inch of absorbed water per week either through natural rainfall or augmented by periodic watering. Apply water at a moderate rate so as not to displace the mulch or flood the plants and turf.
2. Prune plants and replace mulch as required. Under no circumstances is the contractor to prune the tree leader of any trees. Contractor shall not prune multi-stem trees to produce single stem trees.
3. Replace and restore stakes, guy wires, and eroded plant saucers as required.
4. In plant beds and saucers, remove grass, weeds, and other undesired vegetation, including the root growth, before they reach a height of 3 inches.
5. Spray with approved insecticides and fungicides to control pests and ensure plant survival in a healthy growing condition, as directed by the Engineer.
6. Provide the following turf establishment:
    a. Eradicate all weeds. Water, fertilize, over-seed, and perform any other operation necessary to promote the growth of grass.
    b. Replant areas void of turf one square foot and larger in area.
    c. Mow the new lawn at least three times prior to the final inspection. Begin mowing when grass is 4 inches high. Mow to a 2-1/2 inch height.
7. Remove plants that die during this period and replace each plant with one of the same size and species.

1.7 PLANT AND TURF WARRANTY

A. All work shall be in accordance with the terms of the Paragraph, "Warranty" of Section GENERAL CONDITIONS, including the following supplements:

B. A One Year Plant and Turf Warranty will start with the date of material completion. The Contractor shall have completed, located, and installed all plants and turf according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.

C. The Contractor will replace any dead plant material and any areas void of turf immediately.

D. Replacement of relocated plants, that the Contractor did not supply, is not required unless they die from improper handling and care during transplanting. Loss through Contractor negligence requires replacement in kind and size.

E. The Owner’s Representative will re-inspect all plants and turf at the end of the One Year Warranty. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty will end on the date of this inspection provided the Contractor has complied with the work required by this specification. The Contractor shall also comply with the following requirements:

1. Replace dead, missing or defective plant material prior to final inspection. The plant shall be replaced as soon as reasonably possible based upon the growing season, but no later than 6 months after identification of the need of replacement.

2. Mulch and weed plant beds and saucers. Just prior to this inspection, treat these areas to a second application of approved pre-emergent herbicide.
3. From plants having been installed for one year, remove stakes, guy wires and any required tree wrappings.
4. Complete remedial measures directed by the Engineer to ensure plant and turf survival.
5. Repair damage caused while making plant or turf replacements.

1.8 APPLICABLE PUBLICATIONS

A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. American National Standards Institute (ANSI) Publications:

ANSI Z60.1-1996 Nursery Stock

ANSI Z133.1-2000 Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush- Safety Requirements

C. Hortus Third, A Concise Dictionary of Plants Cultivated in the U.S. and Canada, Wiley Publishers, 1976.

D. American Society For Testing And Materials (ASTM) Publications:

C136-05 (Rev. A) Sieve Analysis of Fine and Coarse Aggregates

C516-80 (Rev. 2002) Vermiculite Loose Fill Thermal Insulation

C549-81 (Rev. 2002) Perlite Loose Fill Insulation

D977-98 (Rev. 2003) Emulsified Asphalt (AASTHO M140 1988)

D2028-97 (Rev. 2004) Cutback Asphalt (Rapid-curing Type)

D2103-97 (Rev. 2003) Polyethylene Film and Sheeting

E. Turf Producers International:

Guideline Specifications to Turfgrass Sodding 1995 ed.

F. U. S. Department of Agriculture Federal Seed Act of August 9, 1939:

53 Stat. 1275 Rules and Regulations

G. American Wood Preservative Association (AWPA):

C2-02 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment

PART 2 - PRODUCTS

2.1 GENERAL

All plant and turf material will conform to the varieties specified or shown in the plant list and be true to botanical name as listed in Hortus Third.

2.2 PLANTS

A. Plants shall be in accordance with ANSI Z60.1, except as otherwise stated in the specifications or shown on the plans. Where the drawings or specifications are in conflict with ANSI Z60.1, the drawings and specification shall prevail.

B. Provide well-branched and formed planting stock, sound, vigorous, and free from disease, sunscald, windburn, abrasion, harmful insects or insect eggs with healthy, normal, and unbroken root systems. Provide trees, deciduous and evergreen, that are single trunked with a single leader, unless otherwise indicated, display no weak crotches. Provide symmetrically developed deciduous trees and shrubs of uniform habit of growth, with straight boles or stems and free from objectionable disfigurements, and evergreen trees and shrubs with well developed symmetrical tops with typical spread of branches for each particular species or variety. Provide ground cover and vine plants with the number and length of runners for the size specified, and the proper age for the grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Spray all plants budding into leaf or having soft growth with an anti-desiccant at the nursery before digging.

C. The minimum acceptable sizes of all plants, measured before pruning with branches in normal position, shall conform to the measurements designated. Plants larger in size than specified may be used with the approval of the Engineer, with no change in the contract price. When larger plants are used, increase the ball of earth or spread of roots in accordance with ANSI Z60.1. All shrubs shall be a minimum of eighteen (18) inches in height at time of installation.

D. Provide nursery grown plant material conforming to the requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in a manner that will not cause damage to branches, shape, and future development after planting.

E. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth and tied.

F. Bare-root (BR) plants shall have the root system substantially intact, but with the earth carefully removed. Cover roots with a thick coating of mud by "puddling" after the plants are dug.

G. Container grown plants shall have sufficient root growth to hold the earth intact when removed from containers, but shall not be root bound.

H. Make substitutions only when a plant (or its alternates as specified) is not obtainable and the Engineer authorizes a change order providing for use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics with an equitable adjustment of the contract price.

I. When existing plants are to be relocated, ball sizes shall conform to requirements for collected plants in ANSI Z60.1, and plants shall be dug, handled, and replanted in accordance with applicable sections of these specifications.

2.3 TOPSOIL

A. Topsoil shall be a well-graded soil of good uniform quality. It shall be a natural, friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of

subsoil, foreign matter, objects larger than one inch in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall have a pH value of not less than 5.0 nor more than 7.5.

B. Obtain material from stockpiles established under Section EARTHWORK, subparagraph, Stripping Topsoil, that meets the general requirements as stated above. Amend topsoil not meeting the pH range specified by the addition of pH Adjusters.

C. If sufficient topsoil is not available on the site to meet the depth as specified herein, the Contractor shall furnish additional topsoil. At least 10 days prior to topsoil delivery, notify the Engineer of the source(s) from which topsoil is to be furnished. Obtain topsoil from well drained areas. Additional topsoil shall meet the general requirements as stated above in Section 2.3.A. Amend topsoil not meeting the pH range specified by the addition of pH adjusters.

2.4 LIME

Lime shall be agricultural limestone containing not less than 90 percent calcium and magnesium carbonates. Lime must be ground to such a fineness that not less than 90% must pass No. 8 mesh and not less than 25% must pass No. 100 mesh. Moisture is not to exceed 10%.

2.5 SOIL CONDITIONERS

A. Peat shall be a natural product of peat moss derived from a fresh-water site conforming to Fed. Spec. Q-P-166, except as otherwise specified. Peat shall be shredded and granulated to pass through a 1/2 inch mesh screen and conditioned in storage piles for at least six months after excavation.

B. Coarse Sand

Coarse concrete sand, ASTM C-33 Fine Aggregate, shall be clean, sharp, free of limestone, shale and slate particles and of toxic materials.

C. Perlite shall conform to ASTM C549.

D. Vermiculite shall be horticultural grade and free of any toxic materials and conform to ASTM C516.

E. Pine Bark shall be horticultural-grade milled pine bark, with 80 percent of the material by volume sized between 0.004 in. and 0.59 in.

1. Pine bark shall be aged sufficiently to break down all woody material. Pine bark shall be screened.

2. pH shall range between 4.0 and 7.0.

3. Submit manufacturer’s literature for approval.

F. Organic Matter shall be commercially prepared compost, composted sufficiently to be free of all woody fibers, seeds, and leaf structures, and free of toxic and non-organic matter.

G. Fertilizer: Agricultural fertilizer of a formula indicated by the soil test. Fertilizers shall be organic, slow-release compositions whenever applicable

2.6 PLANT FERTILIZER

A. Provide plant fertilizer that is commercial grade and uniform in composition and conforms to applicable state and federal regulations.

B. For new plant material, provide packet, table, or pellet forms of slow release fertilizers, bearing the manufacturer's warrantee statement of analysis.

C. For existing trees, provide granular fertilizer bearing the manufacturer's warrantee statement of analysis.

2.7 TURF FERTILIZER

Provide turf fertilizer that is commercial grade, free flowing, uniform in composition, and conforms to applicable state and federal regulations.

2.8 MULCH

A. Mulch shall be free from deleterious materials and shall be stored as to prevent inclusion of foreign material.

B. Organic mulch materials shall pine needles:

1. Pine needles for planting beds shall be shall be free from noxious weeds, mold or other objectionable material.

2. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil.

2.9 EROSION CONTROL

A. Erosion control blanket material shall be North American Green S150BN slope Stabilization Matting. Refer to manufacturer’s specifications for installation as well as details.

2.10 TREE WRAP

A. Crinkle Paper Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.

B. Tree wrap shall be secured to the trunk using bio-degradable tape suitable for nursery use and which is expected to degrade in sunlight in less than two years

2.11 STAKES AND GUYING WIRES

A. Provide stakes for tree support of rough sawn wood, free from knots, rot, cross grain, or other defects that would impair the strength. Stakes shall be a minimum of 2 inches by 2 inches in diameter, by 8 feet long and pointed at one end.

B. Guying wire shall be 12 gauge annealed galvanized steel.

C. Hose chafing guards shall be new or used 2-ply reinforced rubber or plastic hose of all the same color on the project.

D. Flags to be fastened to guys shall be surveyor's plastic tape, orange in color and 6 inches in length.

F. Turnbuckles shall be galvanized or cadmium plated and have a 3 inch minimum lengthwise opening fitted with screw eyes.

G. Eye bolts shall be galvanized or cadmium plated having an one inch diameter eye with a minimum screw length of 1-1/2 inches.

H. Deadmen shall be 4 inch by 8 inch rectangular, or 8 inch diameter 36 inch long sound wood.

I. Arrow shaped or auger iron anchors shall be non-corrosive, and sized according to the manufacturer's recommendation.

2.12 WATER

Water shall not contain elements toxic to plant life. It shall be obtained from a local source as specified in Section 014000 QUALITY REQUIREMENTS AND 221100 WATER DISTRIBUTION.

2.13 SEED

Seed shall be state-certified seed of the latest season's crop and shall be delivered in original sealed packages bearing the producer's warrantee analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Onsite seed mixing shall be done only in the presence of the Engineer. Seed mixtures shall be proportioned by weight as follows in the seeding chart shown in the construction drawing. Contractor shall provide proof of seed applied to the Owner’s representative.

2.14 SOD

Sod shall be nursery grown, certified Tifton Bermuda 419 sod as classified in the TPI Guideline Specifications to Turfgrass Sodding. Quality shall conform to ASPA Guideline Specifications for Sodding.

2.15 HERBICIDES

All herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Keep all herbicides in the original labeled containers indicating the analysis and method of use.

PART 3 – EXECUTION

3.1 LAYOUT

Stake plant material locations and bed outlines on project site for approval by the Engineer before any plant pits or beds are dug. The Engineer may approve adjustments to plant material locations to meet field conditions.

3.2 EXCAVATION FOR PLANTING

A. Prior to excavating for plant pits and bed, verify the location of any underground utilities. Damage to utility lines will be repaired at the Contractor's expense. Where lawns have been established prior to planting operation, cover the surrounding turf before excavations are made in a manner that will protect turf areas. Barricade existing trees, shrubbery, and beds that are to be preserved in a manner that will effectively protect them during the project construction.

B. Remove rocks and other underground obstructions to a depth necessary to permit proper planting according to plans and specifications. Where underground utilities, construction,

or solid rock ledges are encountered, the Engineer may select other locations for plant material.

C. Dig plant pits by any approved method so that they have vertical sides and flat bottoms. When pits are dug with an auger and the sides of the pits become glazed, scarify the glazed surface. Size the plant pits as shown, otherwise, the minimum allowable dimensions of plant pits shall be regardless of width, 6 inches deeper for shrubs and 9 inches deeper for trees than the depth of ball or root spread; for ball or root spread up to 2 feet, pit diameters shall be twice the ball or root spread; for ball or root spread from 2 to 4 feet, pit diameters shall be 2 feet greater; for ball or root spread over 4 feet, pit diameters shall be 1-1/2 times the ball or root spread.

D. Where ground cover and planting beds occur in existing turf areas, remove turf to a depth that will ensure the removal of the entire root system, with additional bed preparation as specified in the next paragraph.

E. Where existing soil is to be used in place, till new ground cover and plant beds to a depth of 18 inches minimum. Spread soil amendment uniformly over the bed to depth of 2 inches and thoroughly incorporate it into the existing soil to a depth of 4 inches using a roto-tiller or similar type of equipment to obtain a uniform and well pulverized soil mix. During tillage operations, remove all sticks, stones, roots, and other objectionable materials. Bring plant beds to a smooth and even surface conforming to established grades. The tree pits shall be tilled to a depth of 30 inches minimum to aerate the soil.

F. In areas of new grading where existing soil is being replaced for the construction of new ground cover and plant beds, remove 4 inches of existing soil and replace with topsoil. Plant beds shall be brought to a smooth and even surface conforming to established grades. Till 2 inches of soil amendment into the topsoil as specified.

G. Using topsoil, form earth saucers or water basins for watering around plants. Basins to be 2” high for shrubs and 4” high for trees.

H. Treat plant saucers, shrub, and ground cover bed areas, prior to mulching, with an approved pre-emergent herbicide. Plant ground cover in areas to receive erosion control material through the material after material is in place.

3.3 SETTING PLANTS

A. Handle balled and burlapped and container-grown plants only by the ball or container. Remove container-grown plants in such a way to prevent damage to plants or root system. Set plants plumb and hold in position until sufficient soil has been firmly placed around the roots or ball. Set plants so that the root crown is 1” higher than the surrounding grade. Plant ground cover plants after the mulch is in place. Avoid contaminating the mulch with the planting soil. Add slow release packet, tablet or pellet fertilizer as each plant is installed as per manufacturer's recommendation for method of installation and quantity.

B. Backfill balled and burlapped and container-grown plants with planting soil mixture as specified to approximately half the depth of the ball and then tamp and water. For balled and burlapped plants, carefully remove excess burlap and tying materials and fold back. Where plastic wrap or treated burlap is used in lieu of burlap, completely remove these materials before backfilling. Tamp and water remainder of backfill Planting Soil Mixture; then form earth saucers or water basins around isolated plants with topsoil.

C. Plant bare-root stock arranging the roots in a natural position. Remove damaged roots with a clean cut. Carefully work Planting Soil Mixture in among the roots. Tamp and water the remainder of Planting Soil Mixture; then form earth saucers or water basins around isolated plants with topsoil.

3.4 STAKING AND GUYING

A. Stake and guy plants as shown on the drawings and as specified.

B. Drive stakes vertically into the ground to a depth of 2-1/2 to 3 feet in such a manner as not to injure the ball or roots, unless otherwise shown on the drawings.

C. Place deadmen not less than 18 inches below the surface of the ground, unless otherwise shown on the drawings.

D. Install iron anchors according to manufacturer's recommendations.

E. Fasten flags securely on each guy wire approximately 2/3 of the distance up from ground level.

F. Remove stakes and guy wires after one year.

3.5 EDGING PLANT BEDS

A. Uniformly edge beds using a sharp tool to provide a clear cut division line between the planted area and the adjacent lawn.

3.6 MULCHING PLANTS

A. Mulch within 48 hours after planting and applying a pre-emergent herbicide. Do not mulch in ground cover areas that shall have organic material placed before planting.

B. Placing Organic Material: Spread a mulch of pine straw to a uniform minimum thickness of 3 inches. A minimum of 3 inches of pine needle mulch shall be applied in all beds and in tree saucers.

C. Keep mulch out of the crowns of shrubs and off buildings, sidewalks, light standards, and other structures.

3.7 PRUNING

A. Prune new plant material in the following manner: Remove dead, broken and crossing branches. Prune deciduous trees and shrubs to reduce total amount of anticipated foliage by 1/4 to 1/3 while retaining typical growth habit of individual plants with as much height and spread as is practicable. Make cuts with sharp instruments as close as possible to the branch collar. Do not make flush cuts. Do not make "Headback" cuts at right angles to line of growth. Do not pole trees or remove the leader. Remove trimmings from the site.

3.8 TILLAGE FOR TURF AREAS

Thoroughly till the soil to a depth of at least 4 inches by scarifying, disking, harrowing, or other approved methods. This is particularly important in areas where heavy equipment has been used, and especially under wet soil conditions. Remove all debris and stones larger than one inch remaining on the surface after tillage in preparation for finish grading. To minimize erosion, do not till areas of 3:1 slope ratio or greater. Scarify these areas to one inch depth and remove debris and stones.

3.9 FINISH GRADING

After tilling the soil for bonding of topsoil with the subsoil, spread the topsoil evenly to a minimum depth of 2 inches. Incorporate topsoil at least 2 to 3 inches into the subsoil to avoid soil layering. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic. Complete lawn work only after areas are brought to finished grade.

3.10 APPLICATION OF FERTILIZER FOR TURF AREAS

A. Apply turf fertilizer at the rate of 8 pounds per 1,000 square feet for 12-8-4 fertilizer. In addition, adjust soil acidity and add soil conditioners as required herein for suitable topsoil under PART 2, Paragraph, TOPSOIL.

B. Incorporate fertilizers into the soil to a depth of at least 4 inches as part of the finish grading operation. Immediately restore the soil to an even condition before any turf work.

3.11 MECHANICAL SEEDING

A. Broadcast seed by approved sowing equipment at the rate of 2 pounds per 1,000 square feet of Bermuda seed. Sow one half of the seed in one direction, and the remainder sown at right angles to the first sowing. Cover seed to an average depth of 1/4 inch by means of spike-tooth harrow, culti-packer, or other approved device.

B. Immediately after seeding, firm up the entire area with a roller not exceeding 150 pounds per foot of roller width. Where seeding is performed with a culti-packer-type seeder or where seed is applied in combination with hydro-mulching, no rolling is required. Contractor shall provide proof of seed type applied to the Engineer.

C. Immediately after preparing the seeded area, evenly spread an organic mulch of straw by hand or by approved mechanical blowers at the rate of 2 tons per acre. Application shall allow some sunlight to penetrate and air to circulate but also reduce soil and seed erosion and conserve soil moisture. Anchor mulch by either a mulch tiller, asphalt emulsion, twine, or netting. When asphalt emulsion is used, apply either simultaneously or in a separate application. Take precautionary measures to prevent asphalt materials from marking or defacing structures, pavements, utilities, or plantings.

3.12 SODDING

A. Accomplish sodding in accordance with the ASPA Guideline Specifications for sodding. Lay sod at right angles to slope or the flow of water. On slope areas, start at the bottom of the slope. All sod shall be laid with seams abutting each piece and with no gaps, no overlaps, no depressions or humps.

B. After completing the sodding operation, blend the edges of the sodded area smoothly into the surrounding area.

3.13 WATERING

Apply water to the turf areas immediately following installation at a rate sufficient to ensure thorough wetting of the soil to a depth of at least 4 inches. Supervise watering operation to prevent run-off. Supply all pumps, hoses, pipelines, and sprinkling equipment. Repair all areas damaged by water operations.

3.14 PROTECTION OF TURF AREAS

Immediately after installation of the turf areas, protect against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.15 RESTORATION AND CLEAN-UP

Where existing or new turf areas have been damaged or scarred during planting and construction operations, restore disturbed area to their original condition. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. In areas where planting and turf work have been completed, clear the area of all debris, spoil piles, and containers. Clear all other paved areas when work in adjacent areas is completed. Remove all debris, rubbish and excess material from the construction site.

END OF SECTION 329000

SECTION 33051 - WATER DISTRIBUTION

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 water-distribution piping and specialties outside the building for the following:

1. Water mains and services.
2. Fire-service mains.

1.3 DEFINITIONS

A. Fire-Service Main: Exterior fire-suppression-water piping.

B. Water Service: Exterior domestic-water piping.

C. The following are industry abbreviations for plastic materials:

1. PVC: Polyvinyl chloride plastic.
2. D.I.: Ductile Iron

1.4 SUBMITTALS

A. Product Data: For the following:

1. Piping specialties.
2. Valves and accessories.
3. Water meters and accessories.
4. Backflow preventers and assemblies.
5. Fire hydrants.
6. Fire department connections.

B. Shop Drawings: For the following:

1. Precast concrete vaults, including frames and hatches, ladders, and drains.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include connection 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. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.6 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.

1.7 PROJECT CONDITIONS

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

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

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.

a. 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.

a. Gaskets: AWWA C111, rubber.

C. Ductile-Iron Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-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.

D. Ductile-Iron Expansion Joints: 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.

2.3 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers:

    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. Grinnell Corporation; Mueller Co.; Water Products Div.
    g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    h. McWane, Inc.; Kennedy Valve Div.
    i. McWane, Inc.; Tyler Pipe; Utilities Div.
    j. Mueller
    k. NIBCO INC.
    l. United States Pipe and Foundry Company.

2. OS&Y, Rising-Stem, Metal-Seated Gate Valves: AWWA C500, cast-iron or ductile-iron body and bonnet, outside screw and yoke, cast-iron double disc, bronze disc and seat rings, and bronze stem.

    a. Minimum Working Pressure: 200 psig.
    b. End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. 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," bottom section with base of size to fit over valve, and approximately 5-inch-diameter barrel.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

B. Indicator Posts: UL 789, FM-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.

2.6 CHECK VALVES

A. AWWA Check Valves:

1. Available Manufacturers:

    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Grinnell Corporation; Mueller Co.; Water Products Div.
    f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    g. McWane, Inc.; Kennedy Valve Div.
    h. McWane, Inc.; M & H Valve Company Div.
    i. NIBCO INC.
    j. Valve and Primer Corp.
    k. Watts Industries, Inc.; Water Products Div.

2. Check Valves: AWWA C508, swing-check type with 175-psig working-pressure rating and resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

2.7 DETECTOR CHECK VALVES

A. Available Manufacturers:

1. Ames Co., Inc.
2. Badger Meter, Inc.

3. CMB Industries, Inc.; Febco Div.
4. Firematic Sprinkler Devices, Inc.
5. Globe Fire Sprinkler Corporation.
6. Grinnell Corporation; Mueller Co.; Hersey Meters.
7. McWane, Inc.; Kennedy Valve Div.
8. Smith-Blair, Inc.
9. Victaulic Co. of America.
10. Viking Corporation.
11. Watts Industries, Inc.; Water Products Div.

2.8 WATER METERS

A. Water meters shall be furnished by utility company. Contractor to contact utility company for purchase and installation coordination.

2.9 BACKFLOW PREVENTERS

A. Available Manufacturers:

1. Ames Co., Inc.
2. Cla-Val Co.
3. CMB Industries, Inc.; Febco Div.
4. Conbraco Industries, Inc.
5. FLOMATIC Corp.
6. Grinnell Corporation; Mueller Co.; Hersey Meters.
7. Watts Industries, Inc.; Water Products Div.
8. Zurn Industries, Inc.; Wilkins Div.

B. Double-Check-Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Maximum Pressure Loss: 5 psig through middle 1/3 of flow range.

2.10 CONCRETE VAULTS (if required)

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

B. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.

C. Aluminum Frame & Hatch: The access hatch shall be hinged, lockable, and of heavy-duty aluminum.

1. Dimensions: See Contract drawings for application.

2.11 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

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. Aqua Shield.
b. BF Products, Inc.
c. DekoRRa Products.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box, Inc.
g. HydroCowl, Inc.
h. Watts Water Technologies, Inc.

2. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.

a. Standard: ASSE 1060.

b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

1) Housing: Reinforced-aluminum construction.

a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
b) Drain opening for units with drain connection.
c) Access doors with locking devices.
d) Insulation inside housing.
e) Anchoring devices for attaching housing to concrete base.

2) Electric heating cable or heater with self-limiting temperature control.

B. Enclosure Bases:

1. Description: 4-inch- minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.12 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, 150-psig minimum working-pressure design.

1. Manufacturer:
a. Mueller – Model A-24015

2. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
3. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
4. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
5. Exterior Finish: Red alkyd-gloss enamel paint, or other as specified by the utility owner; or Silver alkyd-gloss if private, unless otherwise indicated.

2.13 FIRE DEPARTMENT CONNECTIONS

A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

1. Connections: In accordance with local fire department criteria.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 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 in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 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/FM, nonrising-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.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Connect to water main according to requirements of water utility company and of size and in location indicated.

B. Comply with NFPA 24 for fire-service-main piping materials and installation.

C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

D. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

3.5 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. Detector Check Valves: Install in vault or as shown on the plans.

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install detector check valves for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.7 WATER-METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written requirements.

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 with relief drain in vault or other space 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 VAULT INSTALLATION

A. Install precast concrete vaults (if required) according to ASTM C 891.

B. Connect drain outlet to storm drainage piping if within 20 feet of vault. Refer to Division 2 Section "Storm Drainage."

3.10 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.11 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated, or as directed by the Utility Department or Fire Department.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on two sides of each freestanding fire department connection.

3.13 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after 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 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.14 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

3.15 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. 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 as described below:

      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. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      c. 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 and supply copy to Engineer.

END OF SECTION 330510

SECTION 334200 - STORM CONVEYANCE

DRAINAGE 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.

B. SC DOT Standards & Specifications, latest edition.

1.2 SUMMARY

A. This Section includes storm drainage outside the building.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. HDPE: High density polyethylene

C. CPP: Corrugated polypropylene pipe

D. HPPP: High performance polypropylene pipe

E. RCP: Reinforced Concrete Pipe

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

A. Shop Drawings: Include plans, elevations, details, and attachments for the following:

1. Precast concrete manholes and other structures, including frames, covers, and grates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

1.8 PIPES AND FITTINGS

A. Corrugated PE Drainage Tubing and Fittings: AASHTO M 252, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings to form soiltight joints.

B. Corrugated PE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.

C. Corrugated Polypropylene (CPP) Pipe and Fittings: AASHTO M330 with smooth waterway for coupling joints.

1. 12” - 30” pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
2. 36” - 60” pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
3. Fittings shall conform to ASTM F2881, ASTM F2881 and AASHTO M330, for respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell and spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

D. High Performance Polypropylene Pipe (HPPP) & Fittings:

1. 12” - 60” pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
2. Fittings shall conform to ASTM F2881 and AASHTO M330, for respective diameters. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

E. PVC Sewer Pipe and Fittings: According to the following:

1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

a. Gaskets: ASTM F 477, elastomeric seals.

F. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

1.9 MANHOLES

A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

1.10 CATCH BASINS

A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include flat or slightly inverted grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum, unless otherwise indicated. (See Plans for specific frame & grate application.)
2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
3. Install concrete apron around all frames and grates as indicated on the drawings.

1.11 STORMWATER INLETS

A. Curb Inlets: Vertical curb opening, of materials and dimensions indicated.

B. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates.

C. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

D. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

E. Grate Inlets: Provide StormFlex inserts at all grate inlets. Size to fit each grate inlet.

1.12 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (StormTech) or comparable product by one of the following:

a. Advanced Drainage Systems.
b. CULTEC, Inc.
c. Hancor Inc.

d. Infiltrator Systems, Inc.
e. StormTech LLC.

2. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
3. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel, or as specified by approved manufacturer.
4. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd., or as specified by approved manufacturer.

1.13 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious ratio.

1. Medium Duty: In paved foot-traffic areas.

PART 2 - EXECUTION

2.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."
1. soiltight couplings; and coupled joints.

2.2 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

F. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

G. PE Pipe and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer's written instructions.
2. Install according to ASTM D 2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

H. PP Pipe and Fittings: As follows:

1. Installation shall be in accordance with ASTM D2321 and manufacturer's written guidelines, with the exception that minimum cover in traffic areas for 12” – 48” diameters shall be 1 foot and for 60” diameters, the minimum cover shall be 2 feet in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 95%) material. See manufacturer’s guidelines and technical information for maximum fill heights over pipe.

I. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

J. Chamber Systems: Excavate trenches of width and depth and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

2.3 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and when work stops.
3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
2. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION 334200